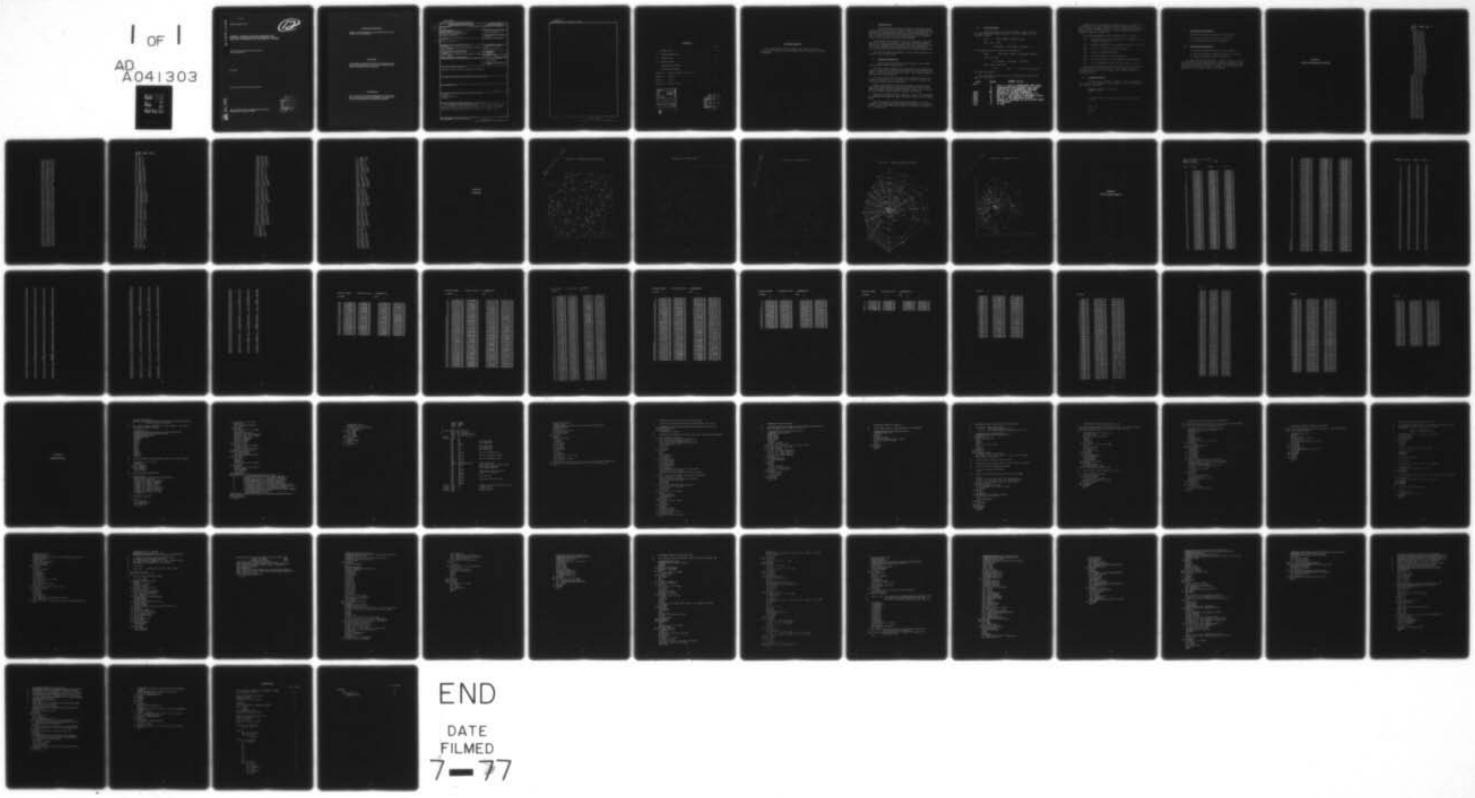
AD-A041 303 ARMY MISSILE RESEARCH AND DEVELOPMENT COMMAND REDSTO--ETC F/G 9/2
GENERAL CONTOUR PLOTTING PROGRAM FOR HOUSTON INSTRUMENTS OR TEK--ETC(U)
APR 77 G E PATRICK

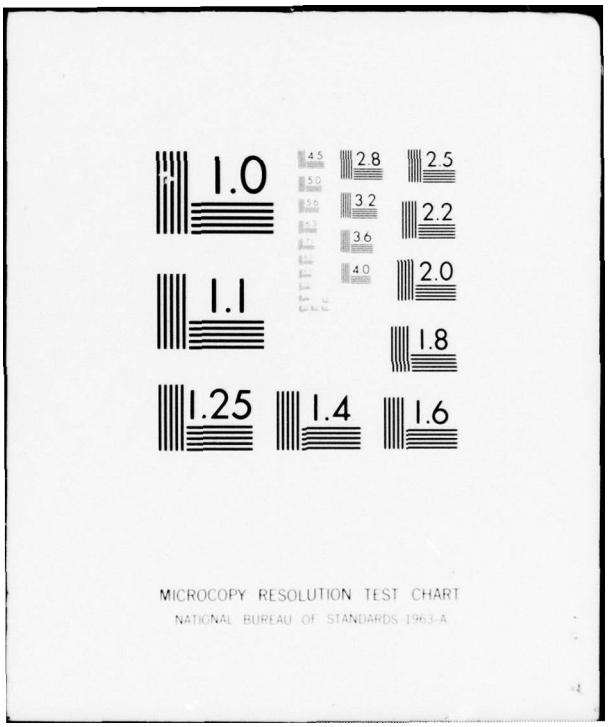
UNCLASSIFIED DRDMI-TL-77-5 NL

1 OF 1
AD A041303



END

DATE FILMED
7-77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

Technical Report TL-77-5

GENERAL CONTOUR PLOTTING PROGRAM FOR HOUSTON INSTRUMENTS OR TEKTRONIX PLOTTERS

Ground Equipment and Missile Structures Directorate
Technology Laboratory

April 1977

US Army Missile Research and Development Command
Redstone Arsenal, Alabama 35809

DISPOSITION INSTRUCTIONS

DESTROY THIS REPORT WHEN IT IS NO LONGER NEEDED. DO NOT RETURN IT TO THE ORIGINATOR.

DISCLAIMER

THE FINDINGS IN THIS REPORT ARE NOT TO BE CONSTRUED AS AN OFFICIAL DEPARTMENT OF THE ARMY POSITION UNLESS SO DESIGNATED BY OTHER AUTHORIZED DOCUMENTS.

TRADE NAMES

USE OF TRADE NAMES OR MANUFACTURERS IN THIS REPORT DOES NOT CONSTITUTE AN OFFICIAL INDORSEMENT OR APPROVAL OF THE USE OF SUCH COMMERCIAL HARDWARE OR SOFTWARE.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TL-77-5	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* GENERAL CONTOUR PLOTTING PROGRAM FOR HOUSTON INSTRUMENTS OR TEKTRONIX PLOTTERS		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER TL-77-5
7. AUTHOR(s) Grady E. Patrick, Jr.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Commander US Army Missile Research and Development Command Attn: DRDMI-TL Redstone Arsenal, Alabama 35809		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DA N/A AMCMS 2200.13.DC01.7.X1
11. CONTROLLING OFFICE NAME AND ADDRESS Commander US Army Missile Research and Development Command Attn: DRDMI-TI Redstone Arsenal, Alabama 35809		12. REPORT DATE April 1977 13. NUMBER OF PAGES 67
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

410 263

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Contours
Triangular patterns
Spline fit

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A generalized computer program has been developed to plot contours on the Houston Instruments and/or Tektronix plotters. Several input options are permitted to increase flexibility of the program. The program is programmed in FORTRAN IV language and implemented on the CDC 6600 computer.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

CONTENTS

ACKNOWLEDGMENTS

Mr. Richard Eppes, Ground Equipment and Missile Structures Directorate, is gratefully acknowledged for his assistance in program development.

I. INTRODUCTION

Several programs have been developed for plotting contours on different types of plotting devices. Most of the programs require ordered arrays or other restrictions on the data being processed. The data for this program have the restriction that the elevation above the x-y plane not be the same as surrounding points; i.e., several points in an area should not be the same elevation.

The program either develops or reads, as input data, triangular patterns from nodal values input. From these triangular elements, each side is investigated to determine if one of the desired contours fall in this element. When all elements have been investigated, the contours are ordered and spline-filled for a smooth curve output.

Note that the density or sparsity of nodal points determines the accuracy of the contour plots.

II. PROGRAM DESCRIPTION

The program is developed in three overlays. Each overlay uses a dynamic core allocation scheme.

The (0,0) overlay determines user preferences as to plotter type, number of points used in spline-fitting spacing of contour labeling, number of contours desired, and their valves. This overlay remains in core during the entire process.

The (1,0) overlay reads the input nodal values and their corresponding elevation and, if not specified by the user, generates the triangular elements from the nodal data.

Overlay (2,0) locates the desired contours as specified in the main overlay and orders these contours for plotting. This routine produces an output of nodal points, elements, and contours in addition to tape 7 which is used in the next overlay for plotting.

Overlay (3,0) reads the data from tape 7, spline fits the data to four times as many points as input, then plots the data on the desired device.

When the triangular elements have been developed, it is only necessary to implement the proper overlay for additional or different contour output. The output on the Houston Instruments is plotted on a 20- $\times$ 20-inch plot.

III. PROGRAM USAGE

Input data may be of one or two forms. If the user does not supply triangular elements as input, the input format is in free formal as follows:

CARD 1 JMAX, (Number of nodes in plot)

CARD 2 thru JMAX

X coordinate, Y coordinate, Z elevation

If a triangular pattern is included, the format is:

CARD 1 JMAX, NELM, (Number of triangular elements)

CARD 2 thru JMAX

X coordinate, Y coordinate, Z elevation

CARD 3 JMAX +2 thru NELM

Node 1 Node 2 Node 3, of each element

The input is on Tape 1.

When the program begins execution, the following information will appear on the screen:

NAME	VALUE	FORMAT A4,I2
IFLO	1	
	1	ONLY X,Y AND Z COORDINATES ARE INPUT
	2	COORDINATES AND ELEMENTS ARE INPUT
	3	REPLOTTING OF GENERATED CONTOURS
INUM	20	SPACING OF CONTOUR NUMBERING
IPTS	4	SMOOTHING FUNCTION FOR SPLINE FIT
IHIP	0	SET TO 1 FOR HOUSTON INSTRUMENT PLOTS
ITEK	0	SET TO 1 FOR TEKTRONIX OUTPUT
NCON	0	NUMBER OF CONTOURS TO BE PLOTTED 20MAX
CONT	0	TO CONTINUE
END	0	TO END

Regardless of the input used, IFLO must be set to 1, default until a successful run has been completed. After a successful run (i.e., tape 7 has been generated), IFLO set to 2 may be used to generate additional contours. If IFLO is minus, no contour nodes will be plotted (Appendix B, Figures B-2 and B-3).

The following parameters may be changed with each execution:

INUM	Factor which controls the spacing of the numbering of the contours - default 20.
IPTS	Smoothing parameter for the spline-fit routine - default 4.
IHIP	Set to 1 for Houston Instruments' plots.
ITEK	Set to 1 for Tektronix plots.
NCON	Set to the number of contours desired.
CONT	To continue after all other parameters have been set.
END	To end program execution, the input format is A4, I2.

When the desired parameters have been entered and CONT is entered, the program will ask for NCON contours to be entered. These are floating point numbers in free format. Tape 6 contains all of the generated output.

IV. PROGRAM CHANGES

One subroutine is written in compass. This routine returns the amount of core available to the program. This may be replaced by the following subroutine:

```
      SUBROUTINE KOREFL (A, KORE, KFL)
      DIMENSION A(1)

      C

      C  SET KORE equal to or greater than 35 times the number
      of nodes

      C

      KORE = XXX

      RETURN

      END
```

V. HARDWARE REQUIREMENTS

The following hardware requirements are necessary:

a) Houston Instruments' plotter or equivalent.

b) Tektronix 401X terminal or equivalent.

VI. SOFTWARE REQUIREMENTS

The following software requirements are necessary:

a) Houston Instruments' plotting package or equivalent.

b) Tektronix Terminal Control System (TCS).

Two sample problems are presented. Appendix A presents a list of the input data for each sample problem. Appendix B shows the output obtained on the Houston Instruments' plotter for each example. Appendix C presents a list of the output obtained for the first example. Appendix D is the FORTRAN listing of the program.

Appendix A.

SAMPLE PROBLEMS INPUT LISTINGS

INPUT DATA SET 1

```
105 0
  8.5 .5 3.4
  17.4 .4 4.7
  11.8 1.2 4.1
  9.6 2.6 3.0
  16.3 3.1 4.6
  17. 3.7 4.7
  7.9 4.0 2.7
  12.2 4.9 3.9
  12.6 7.4 4.2
   7.3 8.2 3.5
   2.5 8.5 3.4
   5.1 11.4 4.3
   1.8 11.8 4.8
   16.7 12. 5.7
   18. 13.6 5.8
   15.5 13.4 5.9
   6.2 16.8 5.2
   3.8 17.9 5.5
   13.5 18. 5.9
   2.2 19.4 4.9
   9.0 20. 5.8
    17.5 19.5 5.9
   6.7 21.1 6.1
   2.0 23.2 4.6
   3.2 22.9 4.9
   4.5 23.4 5.0
   9.7 24.4 4.4
24.4 1.4 5.
29.2 1.7 4.1
32.4 0.1 3.3
29.0 3.3 4.0
38.3 1.8 2.2
41.8 2.5 2.8
21.4 6.5 4.9
31.3 5.0 3.3
36.1 4.7 2.7
41.1 5.3 3.3
43.2 5.5 3.8
49.4 3.8 2.8
33.4 7.6 3.3
22.2 10.7 4.9
27.1 10.3 4.2
31.8 9.8 3.5
43.3 8.5 4.1
31.1 12.2 4.3
30.8 13.8 4.5
31.8 14.0 4.7
29.8 15.5 4.8
23.1 16.0 5.1
34.9 12.7 4.5
41.4 12.8 5.0
43.3 15.4 5.8
34.0 17.5 5.8
```

37.9 18.3 6.4
39.1 18.0 6.3
33.7 19.8 6.7
39.5 20.5 6.7
30.2 21.4 6.8
37.5 22.0 6.8
42.5 22.3 6.8
23.8 22.3 6.0
22.3 26.1 6.8
24.9 26.3 7.0
42.0 25.4 6.7
48.5 25.1 5.4
10.3 25.6 4.8
8.7 27.0 4.5
4.3 27.2 4.0
2.1 29.7 3.3
14.2 29.0 5.1
19.7 28.4 6.5
33.0 28.5 7.9
29.6 30.5 7.7
25.6 30.7 8.1
48.2 30.8 4.9
44.1 31.3 5.3
46.9 32.9 4.7
45.3 33.1 4.7
39.5 32.5 5.8
13.8 34.5 5.0
10.8 35.8 5.1
19.2 36.0 6.5
20.3 36.9 6.4
27.8 36.3 6.5
40.9 36.6 4.4
47.9 36.4 4.0
1.1 39.4 3.9
13.2 39.3 5.6
33.0 38.5 5.5
18.8 42.1 5.4
35.3 40.6 4.9
36.3 41.7 4.5
43.7 41.1 3.5
28.8 42.2 5.2
32.3 42.8 4.8
15.1 44.6 4.9
14.0 45.9 4.6
18.3 47.4 4.2
15.3 48.3 4.1
18.6 46.0 4.6
24.0 48.5 3.9
32.4 48.5 3.6
38.4 45.6 3.6
41.5 47.0 2.9
47.0 47.5 2.7

INPUT DATA SET 2

```
157 0
0. 0. 4.
0. 10. 5.
0. 20. 6.
0. 30. 7.
0. 40. 8.
0. 50. 9.
0. 60. 10.
0. 70. 11.
0. 80. 12.
0. 90. 13.
0. 100. 14.
0. 120. 15.
0. 130. 16.
0. 150. 17.
0. 180. 18.
0. 200. 19.
-3. 11. 5.
-14. 37. 6.
-17. 41. 7.
-21. 65. 8.
-27. 84. 9.
-30. 93. 10.
-33. 102. 11.
-36. 112. 13.
-39. 121. 15.
-42. 131. 17.
-46. 140. 18.
-53. 158. 19.
-6. 9. 5.
-24. 33. 6.
-30. 41. 7.
-36. 48. 8.
-42. 57. 10.
-48. 65. 12.
-54. 73. 14.
-60. 81. 16.
-66. 89. 18.
-78. 105. 19.
-8. 7. 5.
-16. 13. 6.
-32. 26. 7.
-40. 32. 8.
-48. 37. 10.
-56. 44. 11.
-64. 51. 13.
-72. 57. 14.
-80. 64. 16.
-88. 69. 17.
-96. 76. 18.
-104. 81. 19.
-9. 4. 5.
-18. 7. 6.
-37. 14. 7.
-46. 18. 8.
-55. 21. 10.
```

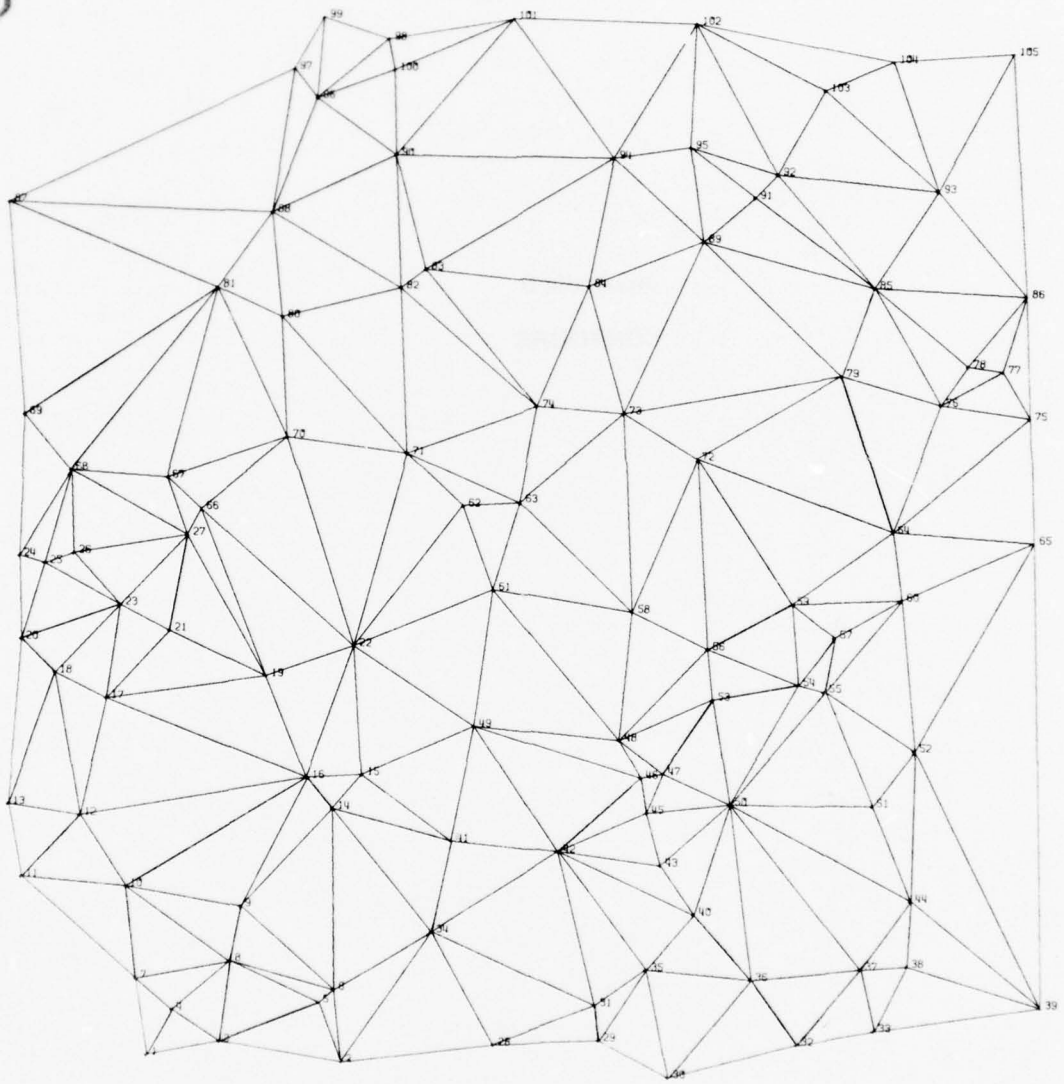
```
-65. 24. 12.
-74. 27. 14.
-83. 30. 16.
-93. 34. 17.
-102. 38. 18.
-110. 41. 19.
-10. -1. 5.
-29. -3. 6
-39. -4. 7.
-49. -5. 8.
-58. -6. 9.
-68. -7. 10.
-78. -8. 11.
-87. -9. 12.
-96. -10. 13.
-106. -11. 15.
-116. -12. 18.
-125. -13. 19.
-9. -4. 5.
-27. -12. 6.
-45. -20. 7.
-54. -24. 8.
-63. -28. 9.
-72. -32. 10.
-81. -36. 11.
-90. -38. 14.
-100. -42. 16.
-109. -44. 19.
-6. -8. 5.
-36. -48. 6.
-42. -56. 7.
-48. -64. 8.
-54. -72. 10.
-60. -80. 11.
-66. -88. 12.
-72. -96. 14.
-78. -104. 15.
-84. -112. 16.
-90. -120. 17.
-96. -128. 18.
-102. -136. 19.
0. -10. 5.
0. -30. 6.
0. -60. 7.
0. -90. 8.
0. -130. 9.
0. -150. 10.
0. -170. 11.
```

```
0. -180. 12.
0. -190. 13.
4. -9. 5.
8. -18. 7.
12. -27. 8.
21 -46. 9.
58. -126. 10.
67. -144. 11.
79. -171. 12.
10. -3. 5.
19. -6. 7.
28. -9. 8.
37. -12. 9.
67. -21. 10.
117. -36. 11.
136. -42. 12.
165. -51. 13.
183. -57. 14.
10. .7 5.
20. 1.5 6.
30. 2.2 8.
50. 3.7 9.
70. 5.2 10.
100. 7.5 11.
110. 8.4 12.
120. 9.1 13.
130. 10. 17.
160. 12.1 18.
180. 13.5 19.
9. 5. 5.
26. 15. 7.
35. 20. 8.
44. 25. 9.
53. 30. 10.
62. 35. 11.
70. 40. 12.
80. 45. 13.
97. 55. 15.
105. 60. 17.
139. 80. 18.
173. 100. 19.
5. 9. 5.
13. 27. 6.
18. 36. 7.
23. 45. 8.
27. 54. 10.
32. 63. 11.
40. 81. 12.
44. 90. 13.
49. 99. 15.
53. 108. 16.
58. 117. 17.
66. 135. 18.
80. 162. 19.
```

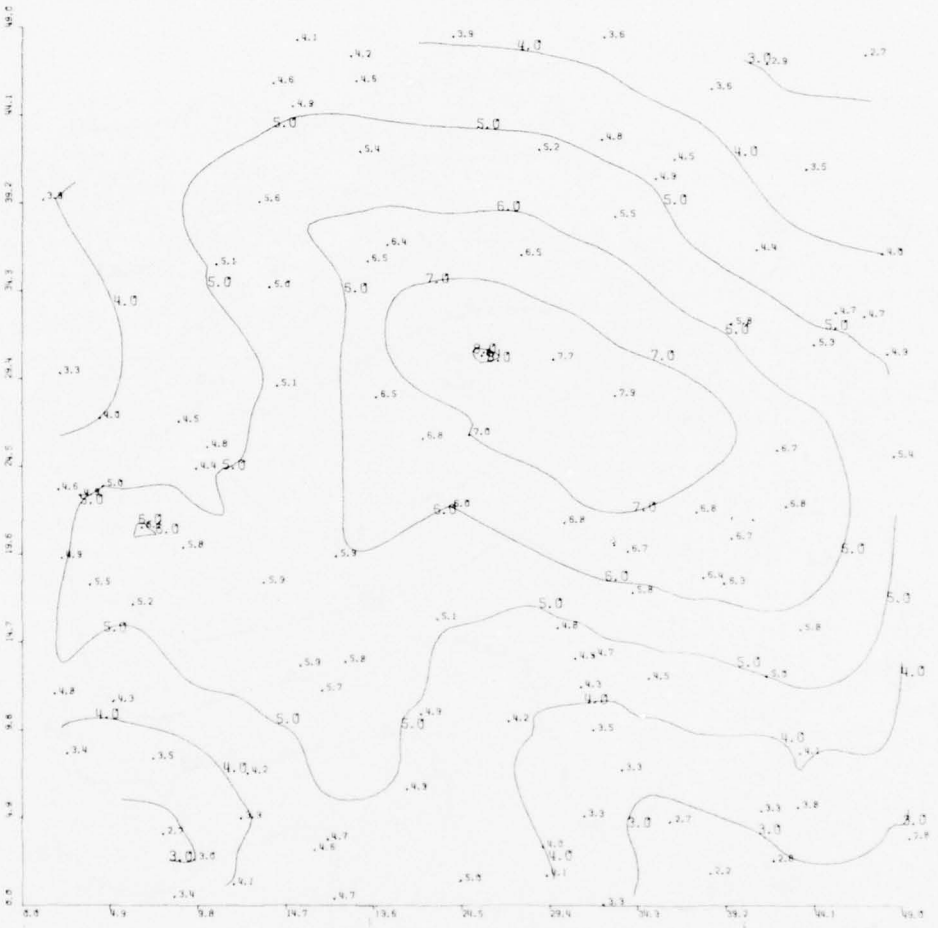
Appendix B.

CONTOURS

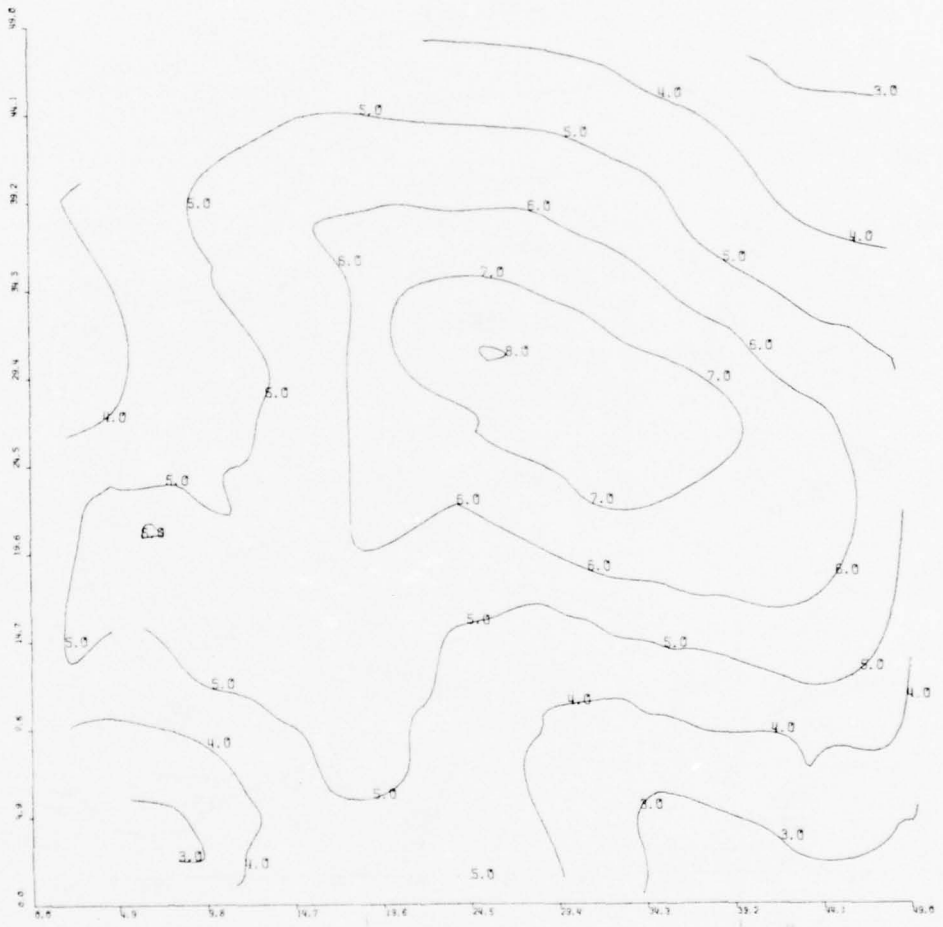
DATA SET 1 – GENERATED TRIANGULAR PATTERN



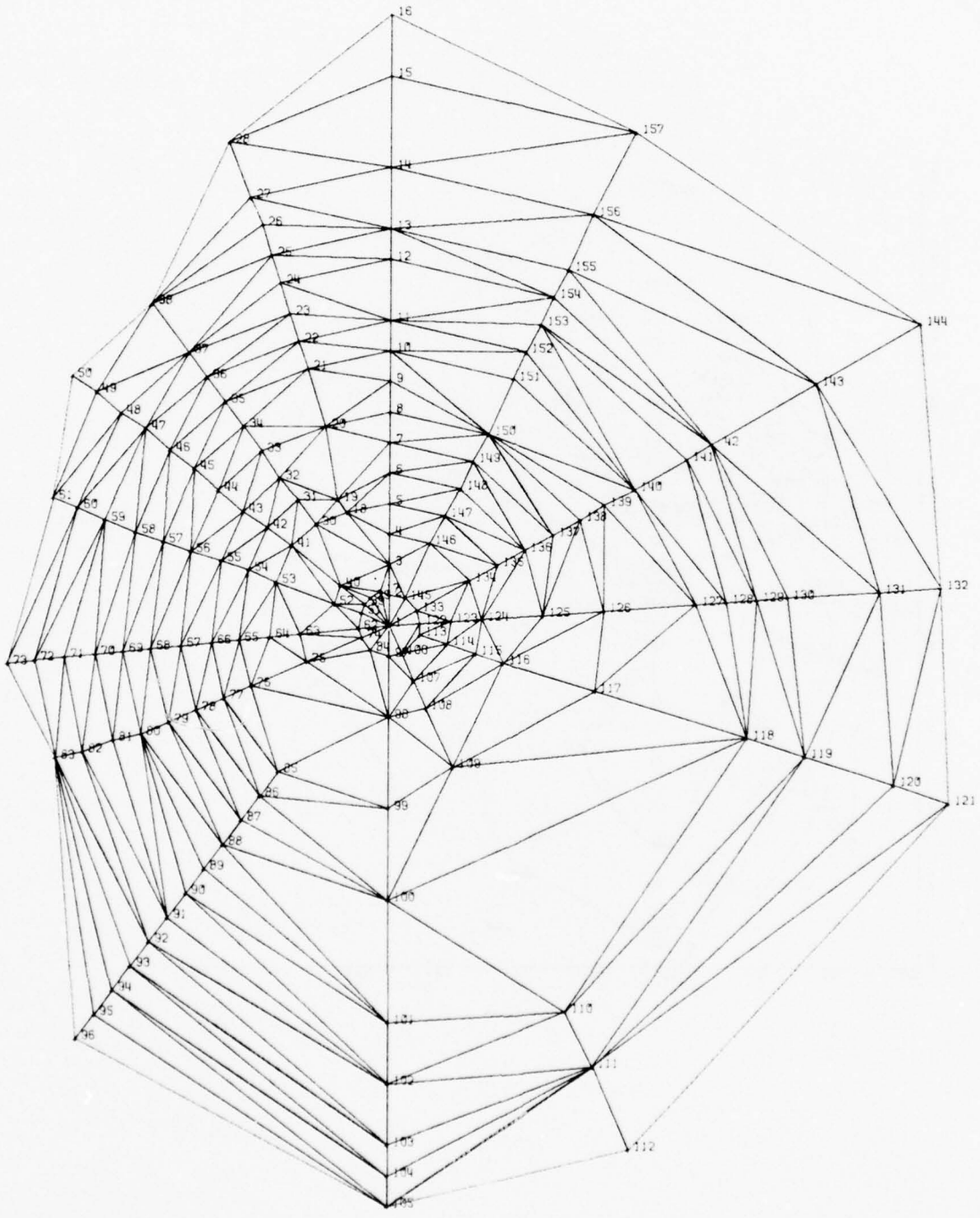
DATA SET 1 – CONTOUR IFLO = +1



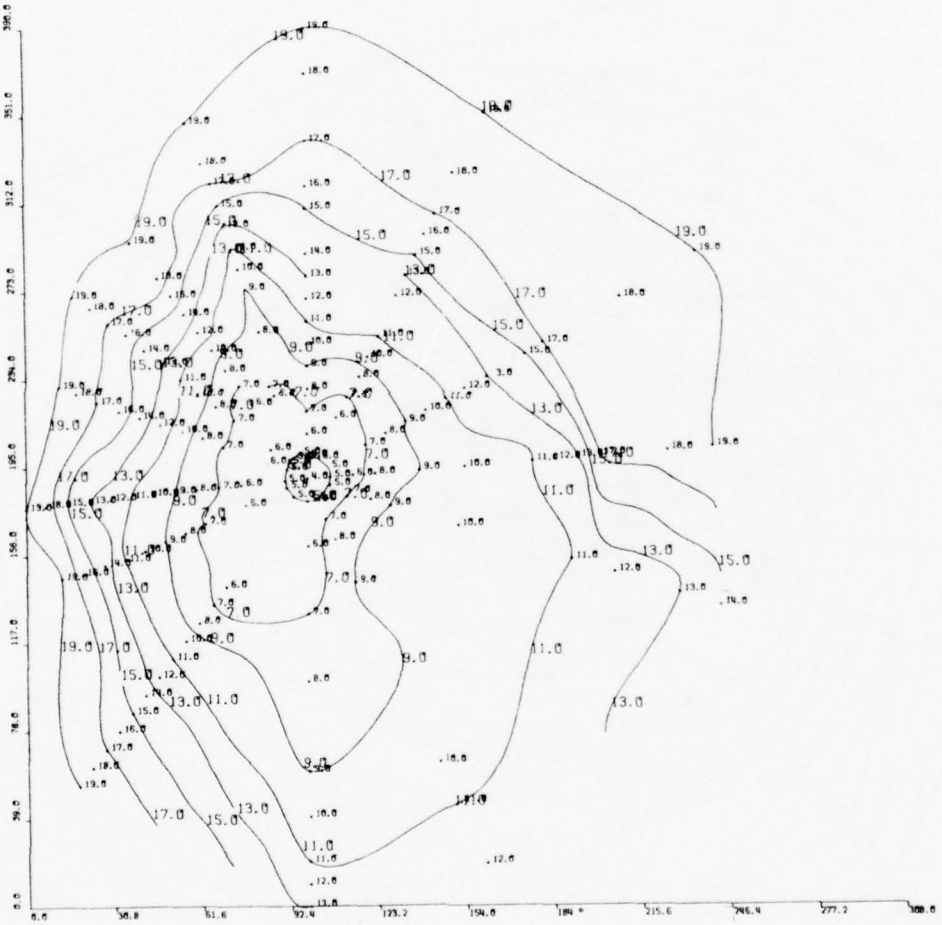
DATA SET 1 – CONTOUR IFLO = -1



DATA SET 2 — GENERATED TRIANGULAR PATTERN



DATA SET 2 — CONTOUR IFLO = +1



Appendix C.

OUTPUT FROM EXAMPLE 1

NUMBER OF CONTOURS TO BE PLOTTED = 6
NUMBER OF NODES = 105
NUMBER OF ELEMENTS = 182

NODE	X-COORD	Y-COORD	VALUE
1	.8500000E+01	.5000000E+00	.3400000E+01
2	.1740000E+02	.4000000E+00	.4700000E+01
3	.1180000E+02	.1200000E+01	.4100000E+01
4	.9600000E+01	.2600000E+01	.3000000E+01
5	.1630000E+02	.3100000E+01	.4600000E+01
6	.1700000E+02	.3700000E+01	.4700000E+01
7	.7900000E+01	.4000000E+01	.2700000E+01
8	.1220000E+02	.4900000E+01	.3900000E+01
9	.1260000E+02	.7400000E+01	.4200000E+01
10	.7300000E+01	.8200000E+01	.3500000E+01
11	.2500000E+01	.8500000E+01	.3400000E+01
12	.5100000E+01	.1140000E+02	.4300000E+01
13	.1800000E+01	.1180000E+02	.4800000E+01
14	.1670000E+02	.1200000E+02	.5700000E+01
15	.1800000E+02	.1360000E+02	.5800000E+01
16	.1550000E+02	.1340000E+02	.5900000E+01
17	.6200000E+01	.1680000E+02	.5200000E+01
18	.3800000E+01	.1790000E+02	.5500000E+01
19	.1350000E+02	.1800000E+02	.5900000E+01
20	.2200000E+01	.1940000E+02	.4900000E+01
21	.9000000E+01	.2000000E+02	.5800000E+01
22	.1750000E+02	.1950000E+02	.5900000E+01
23	.6700000E+01	.2110000E+02	.6100000E+01
24	.2000000E+01	.2320000E+02	.4600000E+01
25	.3200000E+01	.2290000E+02	.4900000E+01
26	.4500000E+01	.2340000E+02	.5000000E+01
27	.9700000E+01	.2440000E+02	.4400000E+01
28	.2440000E+02	.1400000E+01	.5000000E+01
29	.2920000E+02	.1700000E+01	.4100000E+01
30	.3240000E+02	.1000000E+00	.3300000E+01
31	.2900000E+02	.3300000E+01	.4000000E+01
32	.3830000E+02	.1800000E+01	.2200000E+01
33	.4180000E+02	.2500000E+01	.2800000E+01
34	.2140000E+02	.6500000E+01	.4900000E+01
35	.3130000E+02	.5000000E+01	.3300000E+01
36	.3610000E+02	.4700000E+01	.2700000E+01
37	.4110000E+02	.5300000E+01	.3300000E+01
38	.4320000E+02	.5500000E+01	.3800000E+01
39	.4940000E+02	.3800000E+01	.2800000E+01
40	.3340000E+02	.7600000E+01	.3300000E+01
41	.2220000E+02	.1070000E+02	.4900000E+01
42	.2710000E+02	.1030000E+02	.4200000E+01
43	.3180000E+02	.9800000E+01	.3500000E+01
44	.4330000E+02	.8500000E+01	.4100000E+01
45	.3110000E+02	.1220000E+02	.4300000E+01
46	.3080000E+02	.1380000E+02	.4500000E+01
47	.3180000E+02	.1400000E+02	.4700000E+01
48	.2980000E+02	.1550000E+02	.4800000E+01
49	.2310000E+02	.1600000E+02	.5100000E+01
50	.3490000E+02	.1270000E+02	.4500000E+01
51	.4140000E+02	.1280000E+02	.5000000E+01
52	.4330000E+02	.1540000E+02	.5800000E+01
53	.3400000E+02	.1750000E+02	.5800000E+01
54	.3790000E+02	.1830000E+02	.6400000E+01

55	.3910000E+02	.1800000E+02	.6300000E+01
56	.3370000E+02	.1980000E+02	.6700000E+01
57	.3950000E+02	.2050000E+02	.6700000E+01
58	.3020000E+02	.2140000E+02	.6800000E+01
59	.3750000E+02	.2200000E+02	.6800000E+01
60	.4250000E+02	.2230000E+02	.6800000E+01
61	.2380000E+02	.2230000E+02	.6000000E+01
62	.2230000E+02	.2610000E+02	.6800000E+01
63	.2490000E+02	.2630000E+02	.7000000E+01
64	.4200000E+02	.2540000E+02	.6700000E+01
65	.4850000E+02	.2510000E+02	.5400000E+01
66	.1030000E+02	.2560000E+02	.4800000E+01
67	.8700000E+01	.2700000E+02	.4500000E+01
68	.4300000E+01	.2720000E+02	.4000000E+01
69	.2100000E+01	.2970000E+02	.3300000E+01
70	.1420000E+02	.2900000E+02	.5100000E+01
71	.1970000E+02	.2840000E+02	.6500000E+01
72	.3300000E+02	.2850000E+02	.7900000E+01
73	.2960000E+02	.3050000E+02	.7700000E+01
74	.2560000E+02	.3070000E+02	.8100000E+01
75	.4820000E+02	.3080000E+02	.4900000E+01
76	.4410000E+02	.3130000E+02	.5300000E+01
77	.4690000E+02	.3290000E+02	.4700000E+01
78	.4530000E+02	.3310000E+02	.4700000E+01
79	.3950000E+02	.3250000E+02	.5800000E+01
80	.1380000E+02	.3450000E+02	.5000000E+01
81	.1080000E+02	.3580000E+02	.5100000E+01
82	.1920000E+02	.3600000E+02	.6500000E+01
83	.2030000E+02	.3690000E+02	.6400000E+01
84	.2780000E+02	.3630000E+02	.6500000E+01
85	.4090000E+02	.3660000E+02	.4400000E+01
86	.4790000E+02	.3640000E+02	.4000000E+01
87	.1100000E+01	.3940000E+02	.3900000E+01
88	.1320000E+02	.3930000E+02	.5600000E+01
89	.3300000E+02	.3850000E+02	.5500000E+01
90	.1880000E+02	.4210000E+02	.5400000E+01
91	.3530000E+02	.4060000E+02	.4900000E+01
92	.3630000E+02	.4170000E+02	.4500000E+01
93	.4370000E+02	.4110000E+02	.3500000E+01
94	.2880000E+02	.4220000E+02	.5200000E+01
95	.3230000E+02	.4280000E+02	.4800000E+01
96	.1510000E+02	.4460000E+02	.4900000E+01
97	.1400000E+02	.4590000E+02	.4600000E+01
98	.1830000E+02	.4740000E+02	.4200000E+01
99	.1530000E+02	.4830000E+02	.4100000E+01
100	.1860000E+02	.4600000E+02	.4600000E+01
101	.2400000E+02	.4850000E+02	.3900000E+01
102	.3240000E+02	.4850000E+02	.3600000E+01
103	.3840000E+02	.4560000E+02	.3600000E+01
104	.4150000E+02	.4700000E+02	.2900000E+01
105	.4700000E+02	.4750000E+02	.2700000E+01

ELEMENT	NODE 1	NODE 2	NODE 3
1	63	62	71
2	63	62	61
3	62	71	22
4	71	63	74
5	62	61	22
6	61	63	58
7	71	22	70
8	63	74	73
9	74	71	82
10	61	22	49
11	63	58	73
12	58	61	48
13	22	70	66
14	70	71	80
15	74	73	84
16	71	82	80
17	82	74	83
18	22	49	15
19	49	61	48
20	58	73	72
21	48	58	56
22	70	66	67
23	66	22	19
24	80	70	81
25	73	84	89
26	84	74	83
27	82	80	88
28	83	82	90
29	49	15	41
30	15	22	16
31	48	49	46
32	73	72	79
33	72	58	56
34	56	48	53
35	66	67	27
36	67	70	81
37	22	19	16
38	19	66	27
39	81	80	88
40	84	89	94
41	89	73	79
42	83	84	94
43	88	82	90
44	90	83	94
45	15	41	14
46	41	49	42
47	16	15	14

48	49	46	42
49	46	48	47
50	72	79	64
51	56	72	59
52	48	53	47
53	53	56	54
54	67	27	68
55	81	67	68
56	19	16	17
57	27	19	21
58	88	81	87
59	89	94	95
60	79	89	85
61	90	88	96
62	94	90	101
63	41	14	34
64	42	41	34
65	14	16	9
66	46	42	45
67	47	46	45
68	79	64	76
69	64	72	59
70	59	56	54
71	53	47	50
72	54	53	50
73	27	68	26
74	68	81	69
75	16	17	12
76	17	19	21
77	21	27	23
78	81	87	69
79	87	88	97
80	94	95	102
81	95	89	91
82	89	85	91
83	85	79	76
84	88	96	97
85	96	90	100
86	90	101	100
87	101	94	102
88	14	34	6
89	34	42	31
90	16	9	10
91	9	14	6
92	42	45	43
93	45	47	50
94	64	76	75
95	59	64	60
96	54	59	57
97	50	54	55

98	68	26	25
99	26	27	23
100	69	68	24
101	17	12	18
102	12	16	10
103	21	17	23
104	95	102	92
105	91	95	92
106	85	91	92
107	76	85	78
108	96	97	99
109	100	96	98
110	101	109	98
111	34	6	2
112	42	31	35
113	31	34	28
114	9	10	8
115	6	9	8
116	45	43	50
117	43	42	40
118	76	75	77
119	75	64	65
120	64	60	65
121	60	59	57
122	57	54	55
123	55	50	51
124	26	25	23
125	25	68	24
126	12	18	13
127	18	17	23
128	10	12	11
129	102	92	103
130	92	85	93
131	85	78	86
132	78	76	77
133	99	96	98
134	6	2	5
135	2	34	28
136	31	35	29
137	35	42	40
138	28	31	29
139	10	8	7
140	8	6	5
141	43	50	40
142	75	77	86
143	60	65	52
144	57	60	55
145	50	51	44
146	51	55	52
147	25	23	20

148	24	25	20
149	18	13	20
150	13	12	11
151	23	18	20
152	11	10	7
153	92	103	93
154	103	102	104
155	85	93	86
156	78	86	77
157	2	5	3
158	35	29	30
159	40	35	36
160	8	7	4
161	5	8	3
162	50	40	36
163	65	52	39
164	52	60	55
165	51	44	52
166	44	50	37
167	103	93	104
168	93	86	105
169	30	35	36
170	7	4	1
171	4	8	3
172	36	50	37
173	52	39	44
174	37	44	38
175	93	104	105
176	36	30	32
177	4	1	3
178	37	36	32
179	39	44	38
180	38	37	33
181	32	37	33
182	38	39	33

CONTOUR NUMBER 1 CONTOUR VALUE = .3000000E+01

ELEMENT			LINE	
	X	Y	X	Y
139	.89750000E+01	.42250000E+01	.76750000E+01	.55750000E+01
152	.76750000E+01	.55750000E+01	.55857143E+01	.59285714E+01
154	.40200000E+02	.47214286E+02	.41057143E+02	.46800000E+02
159	.33700000E+02	.48500000E+01	.34750000E+02	.61500000E+01
160	.89750000E+01	.42250000E+01	.95983017E+01	.26013986E+01
162	.34750000E+02	.61500000E+01	.35900000E+02	.60333333E+01
163	.48993333E+02	.45733333E+01	.49330769E+02	.54384615E+01
167	.41866667E+02	.46016667E+02	.41057143E+02	.46800000E+02
168	.47207692E+02	.44938462E+02	.45762500E+02	.45100000E+02
169	.33700000E+02	.48500000E+01	.34250000E+02	.24000000E+01
170	.95983017E+01	.26013986E+01	.81571429E+01	.25000000E+01
172	.35900000E+02	.60333333E+01	.38600000E+02	.50000000E+01
173	.48993333E+02	.45733333E+01	.48461538E+02	.45230769E+01
175	.41866667E+02	.46016667E+02	.45762500E+02	.45100000E+02
176	.34250000E+02	.24000000E+01	.34009091E+02	.56363636E+00
178	.38600000E+02	.50000000E+01	.40336364E+02	.43454545E+01
179	.48461538E+02	.45230769E+01	.48160000E+02	.41400000E+01
180	.41520000E+02	.36200000E+01	.42080000E+02	.31000000E+01
181	.40336364E+02	.43454545E+01	.41520000E+02	.36200000E+01
182	.48160000E+02	.41400000E+01	.42080000E+02	.31000000E+01

CONTOUR NUMBER 2 CONTOUR VALUE = .4000000E+01

ELEMENT	X	Y	LINE	X	Y
58	.19083333E+01	.39100000E+02		.18117647E+01	.39394118E+02
62	.23653333E+02	.48073333E+02		.24369231E+02	.48015385E+02
74	.54833333E+01	.32072222E+02		.42987436E+01	.27201428E+02
78	.19083333E+01	.39100000E+02		.54833333E+01	.32072222E+02
79	.18117647E+01	.39394118E+02		.29428571E+01	.40328571E+02
80	.32366667E+02	.46600000E+02		.31500000E+02	.46925000E+02
86	.23653333E+02	.48073333E+02		.23228571E+02	.48142857E+02
87	.24369231E+02	.48015385E+02		.31500000E+02	.46925000E+02
90	.11085714E+02	.76285714E+01		.90083333E+01	.92833333E+01
92	.31362500E+02	.11300000E+02		.28442857E+02	.10157143E+02
100	.42987436E+01	.27201428E+02		.20461538E+01	.26200000E+02
102	.90083333E+01	.92833333E+01		.59250000E+01	.10200000E+02
104	.32366667E+02	.46600000E+02		.34133333E+02	.45477778E+02
110	.23228571E+02	.48142857E+02		.22100000E+02	.48133333E+02
112	.29001314E+02	.33009709E+01		.28033333E+02	.91222222E+01
114	.11085714E+02	.76285714E+01		.12333333E+02	.57333333E+01
115	.12333333E+02	.57333333E+01		.12800000E+02	.47500000E+01
116	.31362500E+02	.11300000E+02		.33350000E+02	.11250000E+02
117	.28442857E+02	.10157143E+02		.28500000E+02	.97000000E+01
128	.59250000E+01	.10200000E+02		.42333333E+01	.10433333E+02
129	.34133333E+02	.45477778E+02		.37466667E+02	.43866667E+02
130	.42144444E+02	.38600000E+02		.40000000E+02	.41400000E+02
136	.29001314E+02	.33009709E+01		.29462500E+02	.21125000E+01
137	.28033333E+02	.91222222E+01		.28500000E+02	.97000000E+01
140	.12800000E+02	.47500000E+01		.12785714E+02	.46428571E+01
141	.33350000E+02	.11250000E+02		.34275000E+02	.10575000E+02
150	.42333333E+01	.10433333E+02		.22000000E+01	.99142857E+01
153	.37466667E+02	.43866667E+02		.40000000E+02	.41400000E+02
155	.42144444E+02	.38600000E+02		.47896643E+02	.36403757E+02
158	.29462500E+02	.21125000E+01		.29600000E+02	.15000000E+01
161	.12785714E+02	.46428571E+01		.12000000E+02	.30500000E+01
162	.34275000E+02	.10575000E+02		.35233333E+02	.10477778E+02
163	.46960000E+02	.84400000E+01		.48984615E+02	.13630769E+02
166	.37483333E+02	.96166667E+01		.43025000E+02	.81000000E+01
168	.47896643E+02	.36403757E+02		.47899723E+02	.36403414E+02
171	.12000000E+02	.30500000E+01		.11600000E+02	.13272727E+01
172	.35233333E+02	.10477778E+02		.37483333E+02	.96166667E+01
173	.46960000E+02	.84400000E+01		.43769231E+02	.81384615E+01
174	.43025000E+02	.81000000E+01		.43266667E+02	.75000000E+01
177	.11328571E+02	.11000000E+01		.11600000E+02	.13272727E+01
179	.43769231E+02	.81384615E+01		.43266667E+02	.75000000E+01

CONTOUR NUMBER 3 CONTOUR VALUE = .5000000E+01

ELEMENT	X	Y	LINE	X	Y
12	.28800000E+02	.16633333E+02		.29840000E+02	.16090000E+02
13	.12900000E+02	.27866667E+02		.11609091E+02	.24490909E+02
19	.28800000E+02	.16633333E+02		.25333333E+02	.15833333E+02
21	.29840000E+02	.16090000E+02		.30210526E+02	.15952632E+02
22	.12900000E+02	.27866667E+02		.13283333E+02	.28666667E+02
23	.11609091E+02	.24490909E+02		.10881818E+02	.24218182E+02
29	.21733333E+02	.11022222E+02		.22650000E+02	.13350000E+02
31	.25333333E+02	.15833333E+02		.24383333E+02	.15633333E+02
34	.30210526E+02	.15952632E+02		.30640000E+02	.15900000E+02
36	.13283333E+02	.28666667E+02		.10450000E+02	.34333333E+02
38	.10881818E+02	.24218182E+02		.11220000E+02	.21840000E+02
45	.21733333E+02	.11022222E+02		.21512500E+02	.10862500E+02
46	.22650000E+02	.13350000E+02		.23544444E+02	.15366667E+02
48	.24383333E+02	.15633333E+02		.23544444E+02	.15366667E+02
52	.30640000E+02	.15900000E+02		.32400000E+02	.14954545E+02
55	.10450000E+02	.34333333E+02		.10209091E+02	.35018182E+02
57	.11220000E+02	.21840000E+02		.94000000E+01	.22514286E+02
58	.99916667E+01	.36100000E+02		.89294118E+01	.39335294E+02
59	.30550000E+02	.42500000E+02		.32500000E+02	.41571429E+02
60	.36590909E+02	.37636364E+02		.40300000E+02	.34842857E+02
61	.14828571E+02	.43842857E+02		.15840000E+02	.44100000E+02
62	.20186667E+02	.43806667E+02		.28061538E+02	.43169231E+02
63	.21512500E+02	.10862500E+02		.20812500E+02	.71875000E+01
65	.13964706E+02	.10223529E+02		.14786667E+02	.98533333E+01
71	.32400000E+02	.14954545E+02		.34553846E+02	.14546154E+02
72	.34553846E+02	.14546154E+02		.35689474E+02	.14173684E+02
73	.44999000E+01	.23401899E+02		.45043297E+01	.23400833E+02
74	.10209091E+02	.35018182E+02		.10316667E+02	.35461111E+02
75	.59555556E+01	.15600000E+02		.96500000E+01	.12275000E+02
77	.94000000E+01	.22514286E+02		.86411765E+01	.23235294E+02
78	.99916667E+01	.36100000E+02		.10316667E+02	.35461111E+02
79	.89294118E+01	.39335294E+02		.13680000E+02	.43260000E+02
80	.30550000E+02	.42500000E+02		.29250000E+02	.42987500E+02
81	.32500000E+02	.41571429E+02		.34016667E+02	.40250000E+02
82	.36590909E+02	.37636364E+02		.34016667E+02	.40250000E+02
83	.40300000E+02	.34842857E+02		.43033333E+02	.33066667E+02
84	.14828571E+02	.43842857E+02		.13680000E+02	.43260000E+02
85	.15840000E+02	.44100000E+02		.18700000E+02	.44050000E+02
86	.20186667E+02	.43806667E+02		.18700000E+02	.44050000E+02
87	.28061538E+02	.43169231E+02		.29250000E+02	.42987500E+02
88	.20812500E+02	.71875000E+01		.16910000E+02	.61900000E+01
90	.13964706E+02	.10223529E+02		.12425000E+02	.11450000E+02
91	.14786667E+02	.98533333E+01		.16910000E+02	.61900000E+01
94	.47175000E+02	.30925000E+02		.47955556E+02	.30500000E+02
97	.35689474E+02	.14173684E+02		.36066667E+02	.14172222E+02
98	.44999000E+01	.23401899E+02		.44935323E+01	.23397512E+02
99	.45043297E+01	.23400833E+02		.86411765E+01	.23235294E+02
101	.59555556E+01	.15600000E+02		.43416667E+01	.15191667E+02
102	.96500000E+01	.12275000E+02		.12425000E+02	.11450000E+02
107	.43033333E+02	.33066667E+02		.44700000E+02	.32200000E+02
113	.24385075E+02	.14253731E+01		.24402299E+02	.14009495E+01
118	.47175000E+02	.30925000E+02		.45500000E+02	.32100000E+02
119	.47955556E+02	.30500000E+02		.48260000E+02	.29660000E+02
123	.36066667E+02	.14172222E+02		.41393506E+02	.12799900E+02
124	.44935323E+01	.23397512E+02		.34016667E+01	.22750000E+02
126	.43416667E+01	.15191667E+02		.23714286E+01	.13542857E+02
132	.44700000E+02	.32200000E+02		.45500000E+02	.32100000E+02
135	.24385075E+02	.14253731E+01		.24388353E+02	.13983361E+01
138	.24402299E+02	.14009495E+01		.24402665E+02	.14001666E+01
145	.41393506E+02	.12799900E+02		.41401055E+02	.12797612E+02
147	.34016667E+01	.22750000E+02		.25750000E+01	.19541667E+02
149	.23714286E+01	.13542857E+02		.24666667E+01	.19150000E+02
151	.24666667E+01	.19150000E+02		.25750000E+01	.19541667E+02
163	.44926667E+02	.12306667E+02		.48638462E+02	.21823077E+02
165	.41401055E+02	.12797612E+02		.43300000E+02	.12152941E+02
173	.44926667E+02	.12306667E+02		.43300000E+02	.12152941E+02

CONTOUR NUMBER 4 CONTOUR VALUE = .6000000E+01

ELEMENT	X	Y	LINE X	Y
3	.17866667E+02	.20983333E+02	.18033333E+02	.20233333E+02
5	.23762425E+02	.22283300E+02	.18033333E+02	.20233333E+02
7	.17866667E+02	.20983333E+02	.17735714E+02	.28614286E+02
10	.23762425E+02	.22283300E+02	.23799534E+02	.22295803E+02
12	.23802999E+02	.22296602E+02	.30040000E+02	.19040000E+02
14	.17735714E+02	.28614286E+02	.17733333E+02	.30433333E+02
16	.17400000E+02	.35500000E+02	.17733333E+02	.30433333E+02
19	.23799534E+02	.22295803E+02	.23802999E+02	.22296602E+02
21	.30040000E+02	.19040000E+02	.32263158E+02	.18215789E+02
25	.30400000E+02	.37400000E+02	.32227273E+02	.36681818E+02
27	.17400000E+02	.35500000E+02	.15866667E+02	.37833333E+02
28	.19018182E+02	.38772727E+02	.19700000E+02	.38980000E+02
32	.38880952E+02	.32119048E+02	.38457895E+02	.32289474E+02
34	.32263158E+02	.18215789E+02	.33933333E+02	.18011111E+02
40	.30400000E+02	.37400000E+02	.28184615E+02	.38569231E+02
41	.32227273E+02	.36681818E+02	.38457895E+02	.32289474E+02
42	.28184615E+02	.38569231E+02	.23133333E+02	.38666667E+02
43	.15866667E+02	.37833333E+02	.19018182E+02	.38772727E+02
44	.19700000E+02	.38980000E+02	.23133333E+02	.38666667E+02
50	.38880952E+02	.32119048E+02	.40055556E+02	.30922222E+02
53	.33933333E+02	.18011111E+02	.35300000E+02	.17766667E+02
68	.40055556E+02	.30922222E+02	.43050000E+02	.28350000E+02
72	.35300000E+02	.17766667E+02	.37268421E+02	.17121053E+02
77	.68764706E+01	.21294118E+02	.74666667E+01	.20733333E+02
94	.43050000E+02	.28350000E+02	.44411111E+02	.27500000E+02
97	.37268421E+02	.17121053E+02	.38400000E+02	.17116667E+02
99	.68764706E+01	.21294118E+02	.65000000E+01	.21309091E+02
103	.66444444E+01	.20622222E+02	.74666667E+01	.20733333E+02
119	.44411111E+02	.27500000E+02	.45500000E+02	.25238462E+02
120	.45928571E+02	.23900000E+02	.45500000E+02	.25238462E+02
123	.38400000E+02	.17116667E+02	.39630769E+02	.16800000E+02
124	.64083333E+01	.21250000E+02	.65000000E+01	.21309091E+02
127	.66444444E+01	.20622222E+02	.62166667E+01	.20566667E+02
143	.45928571E+02	.23900000E+02	.43140000E+02	.16780000E+02
146	.39630769E+02	.16800000E+02	.41620000E+02	.16440000E+02
147	.64083333E+01	.21250000E+02	.63250000E+01	.20958333E+02
151	.62166667E+01	.20566667E+02	.63250000E+01	.20958333E+02
164	.43140000E+02	.16780000E+02	.41620000E+02	.16440000E+02

CONTOUR NUMBER 5 CONTOUR VALUE = .7000000E+01

ELEMENT	X	Y	LINE	X	Y
1	.24890932E+02	.26299302E+02		.24892730E+02	.26302936E+02
2	.24890932E+02	.26299302E+02		.24899231E+02	.26297202E+02
4	.24892730E+02	.26302936E+02		.21543750E+02	.29118750E+02
6	.24899231E+02	.26297202E+02		.24918485E+02	.26282910E+02
9	.21543750E+02	.29118750E+02		.21200000E+02	.34343750E+02
11	.24918485E+02	.26282910E+02		.30066667E+02	.23422222E+02
15	.28550000E+02	.33883333E+02		.27112500E+02	.34550000E+02
17	.21200000E+02	.34343750E+02		.22170588E+02	.34711765E+02
20	.30066667E+02	.23422222E+02		.30709091E+02	.22690909E+02
25	.28550000E+02	.33883333E+02		.30681818E+02	.33045455E+02
26	.27112500E+02	.34550000E+02		.22170588E+02	.34711765E+02
32	.35785714E+02	.30214286E+02		.33247368E+02	.31236842E+02
33	.30709091E+02	.22690909E+02		.33525000E+02	.21975000E+02
41	.30681818E+02	.33045455E+02		.33247368E+02	.31236842E+02
50	.35785714E+02	.30214286E+02		.39750000E+02	.26175000E+02
51	.33525000E+02	.21975000E+02		.36681818E+02	.23181818E+02
69	.39750000E+02	.26175000E+02		.36681818E+02	.23181818E+02

CONTOUR NUMBER 6 CONTOUR VALUE = .8000000E+01

ELEMENT	X	Y	LINE	X	Y
4	.25536364F+02	.30300000E+02		.25231250E+02	.30556250E+02
8	.25536364F+02	.30300000E+02		.26600000E+02	.30650000E+02
9	.25231250F+02	.30556250E+02		.25200000E+02	.31031250E+02
15	.26600000F+02	.30650000E+02		.25737500E+02	.31050000E+02
17	.25200000F+02	.31031250E+02		.25288235E+02	.31064706E+02
26	.25737500F+02	.31050000E+02		.25288235E+02	.31064706E+02

CONTOUR	X	Y
.3000E+01	.5585714E+01	.5928571E+01
.3000E+01	.7675000E+01	.5575000E+01
.3000E+01	.8975000E+01	.4225000E+01
.3000E+01	.9598302E+01	.2601399E+01
.3000E+01	.8157143E+01	.2500000E+01
-.3000E+01	.4020000E+02	.4721429E+02
-.3000E+01	.4105714E+02	.4680000E+02
-.3000E+01	.4186667E+02	.4601667E+02
-.3000E+01	.4576250E+02	.4510000E+02
-.3000E+01	.4720769E+02	.4493846E+02
.3000E+01	.4933077E+02	.5438462E+01
.3000E+01	.4899333E+02	.4573333E+01
.3000E+01	.4846154E+02	.4523077E+01
.3000E+01	.4816000E+02	.4140000E+01
.3000E+01	.4208000E+02	.3100000E+01
.3000E+01	.4152000E+02	.3620000E+01
.3000E+01	.4033636E+02	.4345455E+01
.3000E+01	.3860000E+02	.5000000E+01
.3000E+01	.3590000E+02	.6033333E+01
.3000E+01	.3475000E+02	.6150000E+01
.3000E+01	.3370000E+02	.4850000E+01
.3000E+01	.3425000E+02	.2400000E+01
.3000E+01	.3400909E+02	.5636364E+00

CONTOUR	X	Y
.4000E+01	.2942857E+01	.4032857E+02
.4000E+01	.1811765E+01	.3939412E+02
.4000E+01	.1908333E+01	.3910000E+02
.4000E+01	.5483333E+01	.3207222E+02
.4000E+01	.4298744E+01	.2720143E+02
.4000E+01	.2046154E+01	.2620000E+02
-.4000E+01	.2210000E+02	.4813333E+02
-.4000E+01	.2322857E+02	.4814286E+02
-.4000E+01	.2365333E+02	.4807333E+02
-.4000E+01	.2436923E+02	.4801538E+02
-.4000E+01	.3150000E+02	.4692500E+02
-.4000E+01	.3236667E+02	.4660000E+02
-.4000E+01	.3413333E+02	.4547778E+02
-.4000E+01	.3746667E+02	.4386667E+02
-.4000E+01	.4000000E+02	.4140000E+02
-.4000E+01	.4214444E+02	.3860000E+02
-.4000E+01	.4789664E+02	.3640376E+02
.4000E+01	.2200000E+01	.9914286E+01
.4000E+01	.4233333E+01	.1043333E+02
.4000E+01	.5925000E+01	.1020000E+02
.4000E+01	.9008333E+01	.9283333E+01
.4000E+01	.1108571E+02	.7628571E+01
.4000E+01	.1233333E+02	.5733333E+01
.4000E+01	.1280000E+02	.4750000E+01
.4000E+01	.1278571E+02	.4642857E+01
.4000E+01	.1200000E+02	.3050000E+01
.4000E+01	.1160000E+02	.1327273E+01
.4000E+01	.1132857E+02	.1100000E+01
-.4000E+01	.2960000E+02	.1500000E+01
-.4000E+01	.2946250E+02	.2112500E+01
-.4000E+01	.2900131E+02	.3300971E+01
-.4000E+01	.2803333E+02	.9122222E+01
-.4000E+01	.2850000E+02	.9700000E+01
-.4000E+01	.2844286E+02	.1015714E+02
-.4000E+01	.3136250E+02	.1130000E+02
-.4000E+01	.3335000E+02	.1125000E+02
-.4000E+01	.3427500E+02	.1057500E+02
-.4000E+01	.3523333E+02	.1047778E+02
-.4000E+01	.3748333E+02	.9616667E+01
-.4000E+01	.4302500E+02	.8100000E+01
-.4000E+01	.4326667E+02	.7500000E+01
-.4000E+01	.4376923E+02	.8138462E+01
-.4000E+01	.4696000E+02	.8440000E+01
-.4000E+01	.4898462E+02	.1363077E+02

CONTOUR	X	Y
.5000E+01	.2440230E+02	.1400950E+01
.5000E+01	.2438507E+02	.1425373E+01
.5000E+01	.2438835E+02	.1398336E+01
-.5000E+01	.4826000E+02	.2966000E+02
-.5000E+01	.4785556E+02	.3050000E+02
-.5000E+01	.4717500E+02	.3092500E+02
-.5000E+01	.4550000E+02	.3210000E+02
-.5000E+01	.4470000E+02	.3220000E+02
-.5000E+01	.4303333E+02	.3306667E+02
-.5000E+01	.4030000E+02	.3484286E+02
-.5000E+01	.3659091E+02	.3763636E+02
-.5000E+01	.3491667E+02	.4025000E+02
-.5000E+01	.3250000E+02	.4157143E+02
-.5000E+01	.3055000E+02	.4250000E+02
-.5000E+01	.2925000E+02	.4299750E+02
-.5000E+01	.2806154E+02	.4316923E+02
-.5000E+01	.2018667E+02	.4380667E+02
-.5000E+01	.1870000E+02	.4405000E+02
-.5000E+01	.1584000E+02	.4410000E+02
-.5000E+01	.1482857E+02	.4384286E+02
-.5000E+01	.1368000E+02	.4326000E+02
-.5000E+01	.8929412E+01	.3933529E+02
-.5000E+01	.9991667E+01	.3610000E+02
-.5000E+01	.1031667E+02	.3546111E+02
-.5000E+01	.1020909E+02	.3501818E+02
-.5000E+01	.1045000E+02	.3433333E+02
-.5000E+01	.1328333E+02	.2866667E+02
-.5000E+01	.1290000E+02	.2786667E+02
-.5000E+01	.1160909E+02	.2449091E+02
-.5000E+01	.1088182E+02	.2421818E+02
-.5000E+01	.1122000E+02	.2184000E+02
-.5000E+01	.9400000E+01	.2251429E+02
-.5000E+01	.8641176E+01	.2323529E+02
-.5000E+01	.4504330E+01	.2340083E+02
-.5000E+01	.4499900E+01	.2340190E+02
-.5000E+01	.4493532E+01	.2330751E+02
-.5000E+01	.3491667E+01	.2275000E+02
-.5000E+01	.2575000E+01	.1954167E+02
-.5000E+01	.2466667E+01	.1915000E+02
-.5000E+01	.2371429E+01	.1354286E+02
-.5000E+01	.4341667E+01	.1519167E+02
-.5000E+01	.5955556E+01	.1560000E+02
-.5000E+01	.9650000E+01	.1227500E+02
-.5000E+01	.1242500E+02	.1145000E+02
-.5000E+01	.1396471E+02	.1022353E+02
-.5000E+01	.1478667E+02	.9853333E+01
-.5000E+01	.1691000E+02	.6190000E+01
-.5000E+01	.2081250E+02	.7187500E+01
-.5000E+01	.2151250E+02	.1086250E+02
-.5000E+01	.2173333E+02	.1102222E+02
-.5000E+01	.2265000E+02	.1335000E+02
-.5000E+01	.2354444E+02	.1534667E+02
-.5000E+01	.2438333E+02	.1563333E+02
-.5000E+01	.2533333E+02	.1583333E+02
-.5000E+01	.2880000E+02	.1663333E+02
-.5000E+01	.2984000E+02	.1680000E+02
-.5000E+01	.3021053E+02	.1595263E+02
-.5000E+01	.3064000E+02	.1590000E+02
-.5000E+01	.3240000E+02	.1495455E+02
-.5000E+01	.3455385E+02	.1454615E+02
-.5000E+01	.3568947E+02	.1417368E+02
-.5000E+01	.3606667E+02	.1417222E+02
-.5000E+01	.4139351E+02	.1279990E+02
-.5000E+01	.4140105E+02	.1279761E+02
-.5000E+01	.4330000E+02	.1215294E+02
-.5000E+01	.4492667E+02	.1230667E+02
-.5000E+01	.4863846E+02	.2182308E+02

CONTOUR	X	Y
.6000E+01	.1786667E+02	.2098333E+02
.6000E+01	.1803333E+02	.2023333E+02
.6000E+01	.2376243E+02	.2228330E+02
.6000E+01	.2379953E+02	.2229580E+02
-.6000E+01	.1786667E+02	.2098333E+02
-.6000E+01	.1773571E+02	.2861429E+02
-.6000E+01	.1773333E+02	.3043333E+02
-.6000E+01	.1740000E+02	.3550000E+02
-.6000E+01	.1586667E+02	.3783333E+02
-.6000E+01	.1901818E+02	.3877273E+02
-.6000E+01	.1970000E+02	.3898000E+02
-.6000E+01	.2313333E+02	.3866667E+02
-.6000E+01	.2818462E+02	.3856923E+02
-.6000E+01	.3040000E+02	.3740000E+02
-.6000E+01	.3222727E+02	.3668182E+02
-.6000E+01	.3845789E+02	.3228947E+02
-.6000E+01	.3888095E+02	.3211905E+02
-.6000E+01	.4005556E+02	.3092222E+02
-.6000E+01	.4305000E+02	.2835000E+02
-.6000E+01	.4441111E+02	.2750000E+02
-.6000E+01	.4550000E+02	.2523846E+02
-.6000E+01	.4592857E+02	.2390000E+02
-.6000E+01	.4314000E+02	.1678000E+02
-.6000E+01	.4162000E+02	.1644000E+02
-.6000E+01	.3963077E+02	.1680000E+02
-.6000E+01	.3840000E+02	.1711667E+02
-.6000E+01	.3726842E+02	.1712105E+02
-.6000E+01	.3530000E+02	.1776667E+02
-.6000E+01	.3393333E+02	.1801111E+02
-.6000E+01	.3226316E+02	.1821579E+02
-.6000E+01	.3004000E+02	.1904000E+02
-.6000E+01	.2380300E+02	.2229660E+02
.6000E+01	.6876471E+01	.2129412E+02
.6000E+01	.7466667E+01	.2073333E+02
.6000E+01	.6644444E+01	.2062222E+02
.6000E+01	.6216667E+01	.2056667E+02
.6000E+01	.6325000E+01	.2095833E+02
.6000E+01	.6408333E+01	.2125000E+02
.6000E+01	.6500000E+01	.2130909E+02
.6000E+01	.6876471E+01	.2129412E+02

CONTOUR	X	Y
.7000E+01	.2489093E+02	.2629930E+02
.7000E+01	.2489273E+02	.2630294E+02
.7000E+01	.2154375E+02	.2911875E+02
.7000E+01	.2120000E+02	.3434375E+02
.7000E+01	.2217059E+02	.3471176E+02
.7000E+01	.2711250E+02	.3455000E+02
.7000E+01	.2855000E+02	.3389333E+02
.7000E+01	.3068182E+02	.3304545E+02
.7000E+01	.3324737E+02	.3123684E+02
.7000E+01	.3578571E+02	.3021429E+02
.7000E+01	.3975000E+02	.2617500E+02
.7000E+01	.3668182E+02	.2318182E+02
.7000E+01	.3352500E+02	.2197500E+02
.7000E+01	.3070909E+02	.2269091E+02
.7000E+01	.3006667E+02	.2342222E+02
.7000E+01	.2491849E+02	.2628291E+02
.7000E+01	.2489923E+02	.2629720E+02
.7000E+01	.2489093E+02	.2629930E+02
.8000E+01	.2553636E+02	.3030000E+02
.8000E+01	.2523125E+02	.3055625E+02
.8000E+01	.2520000E+02	.3103125E+02
.8000E+01	.2528824E+02	.3106471E+02
.8000E+01	.2573750E+02	.3105000E+02
.8000E+01	.2660000E+02	.3065000E+02
.8000E+01	.2553636E+02	.3030000E+02

Appendix D.

PROGRAM LISTING

```
      OVERLAY(CONTOUR,0,0)
      PROGRAM MAIN(TAPE1=65,OUTPUT=65,INPUT=TAPE1,TAPE5=65,TAPE6=65,
     1            TAPE7=513,TAPE2=513,TAPE99)
C
C     THIS CONTOUR PROGRAM DEVELOPED BY GRADY PATRICK -- FEB 1977--
C     AT MIRADCOM REDSTONE ARSENAL
C
      DIMENSION NL(3)
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INM,JMAX,NELM,IPT
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      COMMON/HIPLOT/IHI,ITK
      COMMON/CORE/KORE
      NCONTR=0
      IFLOW=1
      INM=20
      JMAX=0
      NELM=0
      IPT=4
      IHI=0
      ITK=0
      KORE=0
      REWIND 1
      REWIND 2
      REWIND 7
C
C     THESE STATEMENTS ARE FOR SYSTEM LOADING IN THE MAIN OVERLAY
C
      IF(JMAX .EQ. 0) GO TO 10
      BACKSPACE 7
      READ(7) NELM
   10 CALL CONNEC(5)
      CALL CONNEC(6)
      WRITE(6,9300)
C
C     ESTABLISH CONTROL PARAMETERS
C
   20 CALL TEK(1)
      WRITE(6,9100) IFLOW,INM,IPT,IHI,ITK,NCONTR
      READ(5,8000) NAME,IVAL
      IF(NAME .EQ. 4HIFLO) IFLOW=IVAL
      IF(NAME .EQ. 4HINUM) INM=IVAL
      IF(NAME .EQ. 4HIPTS) IPT=IVAL
      IF(NAME .EQ. 4HIHIP) IHI=1
      IF(NAME .EQ. 4HITEK) GO TO 30
      IF(NAME .EQ. 4HNCON) NCONTR=IVAL
      IF(NAME .EQ. 4HCONT) GO TO 40
      IF(NAME .EQ. 3HEND) GO TO 500
      GO TO 20
C
C     INITIALIZE TEKTRONIX
C
   30 ITK=1
      CALL INITT(0)
      CALL TERM(3,1024)
      CALL CHRSIZ(3)
      GO TO 20
```

```
   40 IF(IHI .NE. 1) GO TO 50
      REWIND 99
      CALL INITAL(99,100,22,0)
      CALL RSTR(1)
   50 CONTINUE
      IF(IFLOW .EQ. 3) GO TO 300
      CALL TEK(1)
      WRITE(6,9200) NCONTR
      READ(5,*) (VAL(N),N=1,NCONTR)
      IF(IFLOW .GE. 2) GO TO 300
      READ(1,*) JMAX,NELM
      WRITE(7) JMAX,NELM
      DO 100 I=1,JMAX
      READ(1,*) X,Y,Z
  100 WRITE(7) X,Y,Z
      IF(NELM .LE. 0) GO TO 300
      DO 200 I=1,NELM
      READ(1,*) NL(1),NL(2),NL(3)
  200 WRITE(7) (NL(K),K=1,3)
  300 JFLOW=IABS(IFLOW)
      DO 400 I=JFLOW,3
      CALL OVERLAY(7HCONTOUR,I,0)
  400 CONTINUE
      CALL TEK(1)
      IFLOW=3
      IVAL1=IVAL
      IF(IHI .GT. 0) CALL RSTR(2)
      GO TO 10
  500 CONTINUE
      IF(IHI .GT. 0) CALL RSTR(2)
      WRITE(6,9400)
      CALL DISCON(6)
      CALL EXIT
 8000 FORMAT(A4,I2)
 9100 FORMAT(1H *  NAME*7X*VALUE*10X*FORMAT A4,I2*/
     A           * IFLO*9XI2,4X*MINUS TO OMIT POINT NUMBERS*/
     B           15X*1*4X*ONLY X,Y AND Z COORDINATES ARE INPUT*/
     C           15X*2*4X*COORDINATES AND ELEMENTS ARE INPUT*/
     D           15X*3*4X*REPLOTTING OF GENERATED CONTOURS*/
     E           * INUM*9XI2,4X*SPACING OF CONTOUR NUMBERING*/
     F           * IPTS*10XI1,4X*SMOOTHING FUNCTION FOR SPLINE FIT*/
     G           * IHIP*10XI1,4X*SET TO 1 FOR HOUSTON INSTRUMENT PLOTS*/
     H           * ITEK*10XI1,4X*SET TO 1 FOR TEKTRONIX OUTPUT*/
     I           * NCON*10XI1,4X*NUMBER OF CONTOURS TO BE PLOTTED 20MAX*/
     J           * CONT*10X*0*4X*TO CONTINUE*/
     K           * END *10X*0*4X*TO END*//)
 9200 FORMAT(1H * ENTER*I5* CONTOURS IN ASSENDING ORDER FREE FIELD*/)
 9300 FORMAT(1H0)
 9400 FORMAT(1HR)
      END
```

```
      SUBROUTINE TEK(K)
      COMMON/HIPLOT/IHI,ITEK
      IF(ITEK .NE. 1) GO TO 400
      GO TO(100,200),K
  100 CALL ERASE
      CALL HOME
      GO TO 300
  200 CALL NEWLIN
  300 CALL TSEND
      RETURN
  400 WRITE(6,9000)
      RETURN
 9000 FORMAT(1H1)
      END
```

```
          IDENT   KOREFL
          ENTRY   KOREFL
          EXT     CPC
          LIST    D
*
*  CALL KOREFL( A, KORE, KFL )
*         KFL = FIELD LENGTH
*         KORE= KFL - ADDRESS OF A-1.
          VFD     36/0HKOREFL,24/2
A0SAVE    BSS7    1
KOREFL    DATA    0
          SX6     A0
          SB1     X1                      FTN CONVERSION
          SA1     A1+1                    FTN CONVERSION
          SA6     A0SAVE
          SB2     X1                      FTN CONVERSION
          SA1     A1+1                    FTN CONVERSION
          SB3     X1                      FTN CONVERSION
          SX6     B1
          SA6     B1SAVE                  SAVE B1 (ADDRESS OF A)
          SX6     B2
          SA6     B2SAVE                  SAVE B2 (ADDRESS OF KORE)
          SX6     B3
          SA6     B3SAVE                  SAVE B3 (ADDRESS OF KFL)
          MX6     0
          SA6     LENGTH
          MEMORY  CM,LENGTH,RECALL        7EMORY MACRO CALL
          SA1     LENGTH                  LOAD LENGTH INTO X1 (UPPER HALF)
          LX1     30                      SHIFT INTO LOWER HALF
          SX6     X1                      FIELD LENGHT INTO X6
          SA2     B3SAVE
          SA6     X2                      STORE LENGHT INTO USER WORD
          SA2     B1SAVE                  ADDRESS OF A INTO X2
          IX3     X1-X2
          SX6     X3-1                    KORE INTO X6
          SA1     B2SAVE
          SA6     X1                      STORE KORE INTO USER WORD
          SA1     A0SAVE
          SA0     X1
          EQ      KOREFL
LENGTH    DATA    0                       STORAGE FOR LENGTH RETURNED BY CPC
B1SAVE    DATA    0                       STORAGE FOR B1
B2SAVE    DATA    0                       STORAGE FOR B2
B3SAVE    DATA    0                       STORAGE FOR B3
          END
```

```
      OVERLAY(CONTOUR,1,0)
      PROGRAM TRIANG
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
      COMMON/CORE/KORE
      COMMON A(1)
      CALL KOREFL(A,KORE,KFL)
      KORE=64*(KORE/64)
      DO 100 I=1,KORE
  100 A(I)=0.0
      REWIND 7
      READ(7) JMAX,NELM
      J4=2*JMAX
      LK=JMAX+1
      LK1=2*JMAX+1
      LK2=3*JMAX+1
      LK3=4*JMAX+1
      LK4=5*JMAX+1
      LK5=6*JMAX+1
      MK=3*J4
      MK=MK+LK5
      LDIF=KORE-MK
      IF(LDIF .GT. 0) GO TO 200
      CALL TEK(1)
      WRITE(6,9000) MK,KORE
      CALL EXIT
  200 CALL TRI(A(1),A(LK),A(LK1),A(LK2),A(LK3),A(LK4),A(LK5),JMAX,NELM)
 9000 FORMAT(1H1* CORE INSUFFICIENT NEEDED =*I7* AVAILABLE =*I7)
      END
```

```
      SUBROUTINE TRI(X,Y,Z,XR,YR,IOMIT,IELM,JMAX,N1)
C
C     THIS ROUTINE FORMULATES TRIANGLES FROM THE NODAL POINT DATA
C
      DIMENSION X(1),Y(1),Z(1),XR(1),YR(1),IOMIT(1),IELM(3,1),IL(5)
   20 DO 110 IO=1,JMAX
  110 IOMIT(IO)=0
      CALL READ(X,Y,Z,JMAX)
C
C     DETERMINE THE CENTER OF THE NODAL POINT DATA TO BEGIN THE TRIANGLES
C
      CALL CENTER(X,Y,JMAX,J1)
  120 CALL CLOSE(X,Y,Z,JMAX,J1,J2,J3,IOMIT,1)
      CALL ROT(X,Y,XR,YR,JMAX,J1,J2,J3)
      CALL CLOSE(XR,YR,Z,JMAX,J1,J2,J3,IOMIT,2)
      IF(J3 .NE. 0) GO TO 140
      IOMIT(J1)=0
      J1=J2
      GO TO 120
  140 CONTINUE
      N=1
      N1=1
      IELM(1,N1)=J1
      IELM(2,N1)=J2
      IELM(3,N1)=J3
  100 IL(1)=IELM(1,N1)
      IL(2)=IELM(2,N1)
      IL(3)=IELM(3,N1)
      IL(4)=IELM(1,N1)
      IL(5)=IELM(2,N1)
      DO 200 M=1,3
      CALL COMPARE(N,N1,IL(M),IL(M+1),IELM,ICOM)
      IF(ICOM .GT. 0) GO TO 200
      CALL ROT(X,Y,XR,YR,JMAX,IL(M),IL(M+1),IL(M+2))
      J3=0
  160 CALL CLOSE(XR,YR,Z,JMAX,IL(M),IL(M+1),J3,IOMIT,2)
      IF(J3 .EQ. 0) GO TO 200
      CALL SIDECK(N,IL(M),IL(M+1),J3,IELM,ICHK)
      IF(ICHK .EQ. 0) GO TO 165
      IOMIT(J3)=2
      GO TO 160
  165 CALL CHECK(J3,IELM,X,Y,N,ICHK,IOMIT)
      IF(ICHK .EQ. 0) GO TO 170
      IOMIT(J3)=1
      GO TO 160
  170 IF(J3 .EQ. 0) GO TO 200
      N=N+1
      IELM(1,N)=IL(M)
      IELM(2,N)=IL(M+1)
      IELM(3,N)=J3
  200 CONTINUE
      IF(N .EQ. N1) GO TO 300
      N1=N1+1
      GO TO 100
  300 CONTINUE
      REWIND 7
      WRITE(7) JMAX,N1
      DO 400 J=1,JMAX
  400 WRITE(7) X(J),Y(J),Z(J)
      DO 500 N=1,N1
  500 WRITE(7) (IELM(K,N),K=1,3)
      END
```

```
      SUBROUTINE READ(X,Y,Z,JMAX)
C
C     THIS ROUTINE READS THE INPUT DATA AND FINDS THE MAX AND MIN
C     AND THE COORD OF THE CENTER OF THE PLOT
C
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      DIMENSION X(1),Y(1),Z(1)
      XMAX=-1.E20
      YMAX=-1.E20
      XMIN= 1.E20
      YMIN= 1.E20
      IFLAG=0
      DO 100 J=1,JMAX
      READ(7) X(J),Y(J),Z(J)
  100 IF(X(J) .LT. 0.0 .OR. Y(J) .LT. 0.0) IFLAG=1
      IF(IFLAG .EQ. 1) GO TO 500
  200 DO 300 J=1,JMAX
      IF(X(J) .GT. XMAX) XMAX=X(J)
      IF(X(J) .LT. XMIN) XMIN=X(J)
      IF(Y(J) .GT. YMAX) YMAX=Y(J)
      IF(Y(J) .LT. YMIN) YMIN=Y(J)
  300 CONTINUE
      XC=(XMAX+XMIN)*0.5
      YC=(YMAX+YMIN)*0.5
      RETURN
  500 XM=0.0
      YM=0.0
      DO 600 J=1,JMAX
      IF(X(J) .LT. XM) XM=X(J)
      IF(Y(J) .LT. YM) YM=Y(J)
  600 CONTINUE
      DO 700 J=1,JMAX
      X(J)=X(J)-XM
      Y(J)=Y(J)-YM
  700 CONTINUE
      GO TO 200
      END
```

```
      SUBROUTINE CENTER(X,Y,JMAX,J1)
C
C     THIS ROUTINE FINDS THE POINT NEAREST TO THE CENTER
C
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      DIMENSION X(1),Y(1)
      J1=0
      R1=1.E20
      DO 100 J=1,JMAX
      R=SQRT((X(J)-XC)**2+(Y(J)-YC)**2)
      IF(R .GT. R1) GO TO 100
      R1=R
      J1=J
  100 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CLOSE(X,Y,Z,JMAX,J1,J2,J3,IOMIT,K1)
C
C     THIS ROUTINE FINDS BASED ON K1
C        K1 = 1    THE 2 POINTS NEAREST TO J1
C        K1 = 2    THE POINT NEAREST THE AVERAGE OF J1 AND J2
C
      DIMENSION X(1),Y(1),Z(1),IOMIT(1)
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
   50 SCALE=0.0
      XLMIT=1.2*ABS(X(J1))
      J3=0
      XR=0.0
      YR=0.0
      IF(K1 .NE. 1) GO TO 100
      J2=0
      XR=X(J1)
      YR=Y(J1)
  100 R1=1.E20
  200 DO 500 J=1,JMAX
      IF(IOMIT(J) .GT. 0) GO TO 500
      IF(J .EQ. J1 .OR. J .EQ. J2 .OR. J .EQ. J3) GO  TO 500
      IF(K1 .EQ. 1) GO TO 290
C
C     CHECK TO SEE IF POINT IS WITHIN XLIMIT
C
      IF(ABS(X(J)) .LT. XLMIT .AND. Y(J) .GT. SCALE) GO TO 290
C
C     CHECK IF POINT IS GREATER THAN SCALE
C
      IF(Y(J) .LT. SCALE) GO TO 500
      JJ=J1
C
C     CHECK IF POINT IS WITHIN 45 DEG OF J1 AND J2 LINE
C
      A=1.0
      IF(X(J) .LT. 0.0 .AND. X(J1) .LT. 0.0) A=-1.0
      IF(X(J) .LT. 0.0 .AND. X(J2) .LT. 0.0) GO TO 220
      IF(X(J) .GT. 0.0 .AND. X(J1) .LT. 0.0) JJ=J2
  210 XX=A*(X(JJ)-X(J))
      IF(XX .GE. 0.0) GO TO 290
      IF(Y(J)/ABS(XX) .LT. 1.0) GO TO 500
      GO TO 290
  220 JJ=J2
      A=-1.0
      GO TO 210
  290 R=SQRT((X(J)-XR)**2+(Y(J)-YR)**2)
      IF(R .GT. R1) GO TO 500
      R1=R
      GO TO(300,400),K1
  300 J2=J
      GO TO 500
  400 J3=J
  500 CONTINUE
  600 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ROT(X,Y,XR,YR,JMAX,J1,J2,J3)
C
C *** THIS ROUTINE ROTATES ALL POINTS SO THAT THE X AXES LIES ALONG
C *** J1 TO J2 AND THE Y AXES IS DIRECTED AWAY FROM J3
C *** WITH X(J1)= -X(J2)
C
      DIMENSION X(1),Y(1),YR(1),XR(1)
      D=X(J2)-X(J1)
      IF(D .NE. 0.0) GO TO 200
      SN=1.0
      CS=0.0
      XINC=X(J1)
      GO TO 300
  200 IF(Y(J2) .NE. Y(J1)) GO TO 220
      XM=0.0
      DO 210 J=1,JMAX
      XR(J)=X(J)
      YR(J)=Y(J)-Y(J1)
  210 CONTINUE
      GO TO 110
  220 XM=(Y(J2)-Y(J1))/D
      THETA =ATAN(XM)
      SN=SIN(THETA)
      CS=COS(THETA)
  250 XINC=X(J1)-Y(J1)/XM
  300 CONTINUE
      DO 100 J=1,JMAX
      XR(J)=X(J)*CS+Y(J)*SN
  100 YR(J)=XINC*SN+Y(J)*CS-X(J)*SN
C
C     SHIFT X AXES TO THE CENTER OF J1 AND J2
C
  110 XAVG=(XR(J1)+XR(J2))*0.5
      DO 150 J=1,JMAX
  150 XR(J)=XR(J)-XAVG
      IF(J3 .EQ. 0) GO TO 500
      IF(YR(J3) .LE. 0.0) GO TO 500
      DO 400 J=1,JMAX
  400 YR(J)=-YR(J)
  500 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CHECK(JT,IELM,X,Y,N1,ICHK,IOMIT)
C
C *** THIS ROUTINE CHECKS TO SEE IF THE JOINT THAT HAS BEEN FOUND
C *** DOES NOT HAVE ALL THE POSSIBILITIES USED
C
      DIMENSION X(1),Y(1),IELM(3,1),IOMIT(1)
      IF(IOMIT(JT) .GT. 0) GO TO 2000
      PI=3.1415926
      ICHK=0
      ANG1=0.0
      ANG=0.0
      DO 1000 K=1,N1
      DO 100 I=1,3
      IF(IELM(I,K) .EQ. JT) GO TO 200
  100 CONTINUE
      GO TO 1000
  200 GO TO (210,220,230),I
  210 J1=IELM(2,K)
      J2=IELM(3,K)
      GO TO 300
  220 J1=IELM(1,K)
      J2=IELM(3,K)
      GO TO 300
  230 J1=IELM(1,K)
      J2=IELM(2,K)
  300 A2=(X(J1)-X(J2))**2+(Y(J1)-Y(J2))**2
      B=SQRT((X(JT)-X(J1))**2+(Y(JT)-Y(J1))**2)
      C=SQRT((X(JT)-X(J2))**2+(Y(JT)-Y(J2))**2)
      D=(A2-B*B-C*C)/(-2.*B*C)
      IF(ABS(D) .LE. 0.999999) GO TO 400
      ANG1=0.0
      IF(D .LT. 0.0) ANG1=PI
      GO TO 900
  400 CONTINUE
      SIGN=1.
      IF(D .LT. 0.0) SIGN=-1.
      ANG1=ACOS(ABS(D))
      IF(SIGN .GT. 0.0) GO TO 900
      ANG1=PI-ANG1
  900 CONTINUE
      ANG=ANG+ANG1
 1000 CONTINUE
      THET=2.*PI-ANG
      IF(THET .LE. 0.001) ICHK=1
 2000 RETURN
      END
```

```
      SUBROUTINE COMPARE(N,N1,J1,J2,IELM,ICOM)
C
C *** THIS ROUTINE CHECKS TO SEE IF THE JOINTS J1 AND J2 ARE FOUND
C *** IN ANY OTHER TRIANGLE
C
      DIMENSION IELM(3,1)
      ICOM=0
      DO 400 K=1,N
      IF(K .EQ. N1) GO TO 400
      DO 100 K1=1,3
      IF(J1 .NE. IELM(K1,K)) GO TO 100
      GO TO 200
  100 CONTINUE
      GO TO 400
  200 DO 300 K1=1,3
      IF(J2 .NE. IELM(K1,K)) GO TO 300
      GO TO 500
  300 CONTINUE
  400 CONTINUE
      RETURN
  500 ICOM=1
      RETURN
      END
```

```
      SUBROUTINE SIDECK(N,J1,J2,J3,IELM,ICHK)
C
C     THIS SUBROUTINE CHECKS TO SEE IF A PROPOSED TRIANGLE DOES NOT
C     HAVE A SIDE THE SAME AS TWO OTHER TRIANGLES
C     IT RETURNS
C                  ICHK = 0  NONE FOUND
C                  ICHK = 1  TWO SIDES FOUND
C
      DIMENSION IELM(3,1),J(3),JCHK(3),I1(3),I2(3)
      DATA I2/2,3,1/
      DATA I1/1,2,3/
      DO 100 JJ=1,3
  100 JCHK(JJ)=0
      J(1)=J1
      J(2)=J2
      J(3)=J3
C
C     LOOP ON 3 POSSIBILITIES IN A TRIANGLE
C
      DO 600 K1=1,3
      M1=I1(K1)
      M2=I2(K1)
C
C     LOOP ON ALL ELEMENTS
C
      DO 500 K=1,N
C
C     CHECK JOINT J(M1) ON ALL JOINTS IN ELEMENT(K)
C
      DO 200 M=1,3
      IF(J(M1) .EQ. IELM(M,K)) GO TO 300
  200 CONTINUE
      GO TO 500
C
C     IF ONE IS FOUND  CHECK JOINT J(M2) AN ALL JOINTS IN ELEMENT(K)
C
  300 DO 400 M=1,3
      IF(J(M2) .EQ. IELM(M,K)) JCHK(K1)=JCHK(K1)+1
  400 CONTINUE
  500 CONTINUE
  600 CONTINUE
C
C     CHECK IF TWO SIDES WERE FOUND
C
      ICHK=0
      DO 700 JJ=1,3
      IF(JCHK(JJ) .GT. 1) ICHK=1
  700 CONTINUE
      RETURN
      END
```

```
      OVERLAY(CONTOUR,2,0)
      PROGRAM MPCONTR
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
      COMMON/CORE/KORE
      COMMON A(1)
      CALL KOREFL(A,KORE,KFL)
      KORE=64*(KORE/64)
      DO 100 I=1,KORE
  100 A(I)=0.0
      REWIND 7
      READ(7) JMAX,NELM
      LK=JMAX+1
      LK1=2*JMAX+1
      LK2=3*JMAX+1
      MK=3*NELM+LK2
      LDIF=KORE-MK
      IF(LDIF .GT. 0) GO TO 400
      CALL CONNEC(6)
      CALL TEK(1)
      WRITE(6,9000) LDIF,KORE
      CALL EXIT
  400 CALL CONT(A(1),A(LK),A(LK1),A(LK2))
      DO 500 I=1,KORE
  500 A(I)=0.0
      K5=KORE/5
      LK1=2*K5+1
      LK2=4*K5+1
      CALL DISCON(6)
      CALL ORDER(A(1),A(LK1),A(LK2),K5,INUM)
      CALL CONNEC(6)
 9000 FORMAT(1H * CORE INSUFFICIENT NEEDED =*I7* AVAILABLE =*I7)
      END
```

```
      SUBROUTINE CONT(X,Y,Z,IELM)
      DIMENSION X(1),Y(1),Z(1),IELM(3,1)
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
C
C     A CONTOURING PROGRAM FOR RANDOM SPACED POINTS
C     THE POINTS MAY BE RANDOMLY NUMBERED
C     ALL POINTS MUST BE CONNECTED  IN SUCH A MANNER TO FORM
C     NON-OVERLAPING TRIANGLES CALLED ELEMENTS
C
      CALL TEK(1)
C
C     READ THE X - Y COORDINATES AND THE  NODAL VALUE
C
  200 DO 300 J=1,JMAX
  300 READ(7) X(J),Y(J),Z(J)
C
C     READ THE NODES FOR EACH ELEMENT
C
      DO 400 N=1,NELM
  400 READ(7) (IELM(K,N),K=1,3)
      REWIND 7
      WRITE(7) JMAX,NELM
      DO 410 J=1,JMAX
  410 WRITE(7) X(J),Y(J),Z(J)
      DO 420 N=1,NELM
  420 WRITE(7) (IELM(K,N),K=1,3)
      CALL MAXMIN(X,Y,JMAX,IFLOW)
      CALL CONTOUR(X,Y,Z,IELM)
  500 CALL DISCON(6)
      WRITE(6,9000) NCONTR,JMAX,NELM
      WRITE(6,9200)
      DO 600 I=1,JMAX
  600 WRITE(6,9400) I,X(I),Y(I),Z(I)
      WRITE(6,9300)
      DO 700 L=1,NELM
  700 WRITE(6,9500) L,IELM(1,L),IELM(2,L),IELM(3,L)
      REWIND 2
  800 READ(2) K,A,B,I
      IF(EOF(2)) 1300,900
  900 IF(K .GT. 2) GO TO 1200
      GO TO (1000,1100),K
 1000 WRITE(6,9800) I,A,B
      GO TO 800
 1100 WRITE(6,9900) A,B
      GO TO 800
 1200 WRITE(6,9600)I,A
      WRITE(6,9700)
      GO TO 800
 1300 CONTINUE
      CALL CONNEC(5)
      CALL CONNEC(6)
```

```
9000 FORMAT(1H1 *NUMBER OF CONTOURS TO BE PLOTTED =*I5/
    1           * NUMBER OF NODES                    =*I5/
    2           * NUMBER OF ELEMENTS                 =*I5/)
9100 FORMAT(1H0* CONTOURS TO BE PLOTTED *//)
9200 FORMAT(1H0* NODE*4X*X-COORD*11X*Y-COORD*13X*VALUE*//)
9300 FORMAT(1H1* ELEMENT  NODE 1  NODE 2  NODE 3*//)
9400 FORMAT(I5,3E18.7)
9500 FORMAT(4I8)
9600 FORMAT(1H1*CONTOUR NUMBER *I5* CONTOUR VALUE =*E14.7)
9700 FORMAT(1H0* ELEMENT*29X*LINE*/12X*X*14X*Y*19X*X*14X*Y*//)
9800 FORMAT(I5,2E15.8)
9900 FORMAT(1H+,39X,2E15.8)
     END
```

```
      SUBROUTINE CONTOUR(X,Y,Z,IELM)
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
      COMMON/HIPLOT/IHI,ITEK
      DIMENSION X(1),Y(1),IELM(3,1),F(4),TX(4),TY(4)
      DIMENSION LABL(20),IAR(6),Z(1)
      DO 100 I=1,20
  100 LABL(I)=0
      DO 1100 K=1,NCONTR
      N=0
      NCONTR1=NCONTR+10
      WRITE(2) NCONTR1,VAL(K),VAL(K),K
      DO 1000 J=1,NELM
      J1=IELM(1,J)
      J2=IELM(2,J)
      J3=IELM(3,J)
      F(1)=Z(J1)
      F(2)=Z(J2)
      F(3)=Z(J3)
      F(4)=F(1)
      TX(1)=X(J1)
      TX(2)=X(J2)
      TX(3)=X(J3)
      TX(4)=TX(1)
      TY(1)=Y(J1)
      TY(2)=Y(J2)
      TY(3)=Y(J3)
      TY(4)=TY(1)
      IF(K .GT. 1) GO TO 300
      IF(ITEK .NE. 1) GO TO 300
      CALL MOVEA(TX(1),TY(1))
      DO 200 M=2,4
  200 CALL DRAWA(TX(M),TY(M))
  300 CONTINUE
      BA=AMIN1(F(1),F(2),F(3))
      AA=AMAX1(F(1),F(2),F(3))
      IF(VAL(1) .GT. AA .OR. VAL(NCONTR) .LT. BA) GO TO 1100
      IF(VAL(K) .GT. AA .OR. VAL(K) .LT. BA) GO TO 1000
      IBGN=0
      XX1=0.0
      YY1=0.0
      DO 900 L=1,3
      IF(F(L) .EQ. VAL(K)) F(L)=F(L)*1.0001
      IF(F(L+1) .EQ. VAL(K)) F(L+1)=F(L+1)*1.0001
      IF((F(L)-VAL(K))*(VAL(K)-F(L+1))) 900,500,500
  500 ALP=(VAL(K)-F(L))/(F(L+1)-F(L))
      XX=TX(L)+ALP*(TX(L+1)-TX(L))
      YY=TY(L)+ALP*(TY(L+1)-TY(L))
      IF(IBGN .NE. 1) GO TO 800
      IF(XX1 .EQ. XX .AND. YY1 .EQ. YY) GO TO 800
      IF(ITEK .EQ. 1) CALL DASHA(XX,YY,3)
      IBGN1=IBGN+1
      WRITE(2) IBGN1,XX,YY,J
      LABL(K)=LABL(K)+1
      LB=LABL(K)
      IF(MOD(LB,INUM)) 700,600,700
  600 IF(ITEK .NE. 1) GO TO 700
```

```
      CALL CHRSIZ(4)
      CALL FFORM(VAL(K),6,1,IAR,32)
      CALL JUSTER(6,IAR,0,32,LEN,IOFSET)
      CALL MOVREL(IOFSET,0)
      CALL HLABEL(LEN,IAR(6-LEN+1))
  700 IBGN=0
      N=0
      GO TO 900
  800 IF(ITEK .EQ. 1) CALL MOVEA(XX,YY)
      IBGN1=IBGN+1
      IF(N .NE. 0) BACKSPACE 2
      WRITE(2) IBGN1,XX,YY,J
      XX1=XX
      YY1=YY
      IBGN=1
      N=1
  900 CONTINUE
 1000 IBGN=0
 1100 CONTINUE
      IF(ITEK .NE. 1) RETURN
      CALL BELL
      CALL TSEND
      CALL TINPUT(ICR)
      RETURN
      END
```

```
      SUBROUTINE MAXMIN(X,Y,JMAX,IFLOW)
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      COMMON/HIPLOT/IHI,ITEK
      DIMENSION X(1),Y(1)
      IF(IABS(IFLOW) .EQ. 1) GO TO 200
      XMAX=-1.E20
      XMIN= 1.E20
      YMAX=-1.E20
      YMIN= 1.E20
      DO 100 J=1,JMAX
      XMAX=AMAX1(XMAX,X(J))
      XMIN=AMIN1(XMIN,X(J))
      YMAX=AMAX1(YMAX,Y(J))
      YMIN=AMIN1(YMIN,Y(J))
  100 CONTINUE
  200 IF(ITEK .NE. 1) GO TO 300
      CALL SWINDO(200,650,50,650)
      CALL DWINDO(XMIN,XMAX,YMIN,YMAX)
      CALL TEK(1)
  300 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ORDER(X,Y,IFLAG,LMAX,INUM)
C
C     THIS ROUTINE ORDERS THE CONTOUR LINES TO FORM A CONTINOUS LINE
C
      COMMON/HIPLOT/IHI,ITEK
      DIMENSION X(2,1),Y(2,1),IFLAG(1)
      REWIND 2
      ISTOP=0
  100 READ(2) K,CON,CON1,KK
      IF(EOF(2)) 2400,200
  200 MORE=0
      IF(K .GT. 100) GO TO 2400
      DO 300 I=1,LMAX
  300 IFLAG(I)=-1
      CONT=CON
      N=1
      IRED=0
  400 READ(2) J1,A,B,KK
      IF(EOF(2)) 2500,500
  500 CONTINUE
      IF(J1 .GT. 2) GO TO 900
      X(J1,N)=A
      Y(J1,N)=B
      READ(2) J2,C,D,KK
      IF(EOF(2)) 2400,600
  600 CONTINUE
      IF(J2.GT. 2) GO TO 900
      X(J2,N)=C
      Y(J2,N)=D
      Z1=A-C
      Z2=B-D
      IF(ABS(Z1) .GT. 0.001 .AND. ABS(Z2) .GT. 0.001) GO TO 700
      GO TO 400
  700 CONTINUE
      IFLAG(N)=0
      IRED=IRED+1
      N=N+1
      KMAX = N - 1
      IF(IRED .LT. LMAX) GO TO 400
      MORE=1
      DO 800 IBS=1,5
  800 BACKSPACE 2
  900 BACKSPACE 2
      NMAX=1
      K=1
      IF(IRED .LT. 2) GO TO 100
      WRITE(6,9000)
 1000 DO 1400 J1=1,KMAX
      DO 1300 I1= 1, 2
      ILIKE = 0
      IF(IFLAG(J1) .GT. 0) GO TO 1400
      A=X(I1,J1)
      B=Y(I1,J1)
      DO 1200 J = 1, KMAX
      DO 1100 I = 1, 2
      IF(J .EQ. J1 .AND. I .EQ. I1) GO TO 1200
      IF(IFLAG(J) .GT. 0) GO TO 1200
      AA=A-X(I,J)
```

```
      BB=B-Y(I,J)
      IF(ABS(AA) .GT. 0.001 .AND. ABS(BB) .GT. 0.001) GO TO 1100
      ILIKE = ILIKE + 1
      GO TO 1300
1100  CONTINUE
1200  CONTINUE
      IF(ILIKE .EQ. 0) GO TO 1700
1300  CONTINUE
1400  CONTINUE
      DO 1500 J1 = 1, KMAX
      I1 = 1
      IF(IFLAG(J1) .GT. 0) GO TO 1500
      GO TO 1600
1500  CONTINUE
1600  A=X(I1,J1)
      B=Y(I1,J1)
1700  WRITE(7) CONT,A,B
      WRITE(6,9100) CONT,A,B
      K = 1
      IF(I1 .EQ. 1) K = 2
      WRITE(7) CONT,X(K,J1),Y(K,J1)
      WRITE(6,9100) CONT,X(K,J1),Y(K,J1)
      A = X(K,J1)
      B = Y(K,J1)
      IFLAG(J1)=1
      ICHK = 0
1800  DO 2000 J=1,KMAX
      IF(IFLAG(J) .GT. 0) GO TO 2000
      DO 1900 I=1,2
      Z1=A-X(I,J)
      Z2=B-Y(I,J)  .
      IF(ABS(Z1) .GT. 0.001  .OR. ABS(Z2) .GT. 0.001 ) GO TO 1900
      IFLAG(J)=1
      ICHK=0
      N=2
      IF(I .EQ. 2) N=1
      A=X(N,J)
      B=Y(N,J)
      WRITE(7) CONT,A,B
      WRITE(6,9100) CONT,A,B
      NMAX=NMAX+1
      GO TO 2000
1900  CONTINUE
2000  CONTINUE
      IF(NMAX .EQ. KMAX) GO TO 2100
      IF(ICHK .GT. 0) NMAX=NMAX+1
      IF(ICHK .GT. 0) GO TO 2100
      ICHK=1
      GO TO 1800
2100  CONTINUE
      CONT=-1.*CONT
      IF(ISTOP .GT. 0) GO TO 2400
      IF(NMAX .EQ. KMAX .AND. MORE .EQ. 0) GO TO 100
      IF(NMAX .EQ. KMAX .AND. MORE .EQ. 1) GO TO 200
2300  GO TO 1000
2400  CONTINUE
      RETURN
2500  ISTOP=1
      GO TO 1000
9000  FORMAT(1H1* CONTOUR*4X*X*14X*Y*//)
9100  FORMAT(1H F12.4,2(2X,F14.7))
      END
```

```
      OVERLAY(CONTOUR,3,0)
      PROGRAM MPPLOT
      COMMON/CORE/KORE
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      COMMON A(1)
      CALL KOREFL(A,KORE,KFL)
      KORE=64*(KORE/64)
      DO 100 I=1,KORE
  100 A(I)=0.0
      CALL CONNEC(6)
      REWIND 7
      READ(7) JMAX,NELM
      LK=JMAX+1
      LK1=LK+JMAX
      LDIF=KORE-LK1-JMAX
      IF(LDIF .GT. 0) GO TO 150
      CALL TEK(1)
      WRITE(6,9000) LDIF,KORE
      CALL EXIT
  150 CONTINUE
      CALL MXMNPL(A(1),A(LK),A(LK1), JMAX,SIZ,IFLOW)
      DO 200 N=1,NELM
  200 READ(7) I1,I2,I3
C
C     MXNUM  = 100  THIS CONTROLS THE MAXIMUM NUMBER OF CONTOUR POINTS
C                   THAT WILL BE SPLINED FITTED AT ANY ONE TIME
C                   THIS MAY BE INCREASED DEPENDING ON CORE AVAILABLE
C
      MXNUM=100
      IK=MXNUM*IPTS
      LK=MXNUM+1
      LK1=2*MXNUM+1
      LK2=IK+LK1
      LK3=IK+LK2
      LK4=IK+LK3
      LK5=IK+LK4
      LK6=IK+LK5
      LK7=IK+LK6
      LK8=IK+LK7
      LK9=IK+LK8
      LDIF=KORE-LK9
      IF(LDIF .GT. 0) GO TO 300
      CALL TEK(1)
      WRITE(6,9000) LDIF,KORE
      CALL EXIT
  300 CALL SPLINE(A(1),A(LK),A(LK1),A(LK2),A(LK3),A(LK4),A(LK5),
     1            A(LK6),A(LK7),A(LK8),MXNUM,SIZ)
 9000 FORMAT(1H * CORE INSUFFICIENT IN OVERLAY 3*/* NEEDED =*I7
     1          * AVAILABLE =*I7)
      END
```

```
      SUBROUTINE MXMNPL(X,Y,Z,JMAX,SIZ,IFLOW)
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      COMMON/HIPLOT/IHI,ITEK
      DIMENSION X(1),Y(1),Z(1),A1(2),A2(2),IAR(6)
      DATA A1,A2/4*0.0/
      XMAX=-1.E20
      YMAX=-1.E20
      XMIN= 1.E20
      YMIN= 1.E20
      DO 100 J=1,JMAX
      READ(7) X(J),Y(J),Z(J)
      XMAX=AMAX1(XMAX,X(J))
      XMIN=AMIN1(XMIN,X(J))
      YMAX=AMAX1(YMAX,Y(J))
      YMIN=AMIN1(YMIN,Y(J))
  100 CONTINUE
      XMAX=AINT(XMAX+0.5)
      XMIN=AINT(XMIN-0.5)
      YMAX=AINT(YMAX+0.5)
      YMIN=AINT(YMIN-0.5)
      IF(ITEK .NE. 1) GO TO 300
      CALL TEK(1)
      CALL BINITT
      CALL NPTS(2)
      CALL SLIMX(200,850)
      CALL SLIMY(50,700)
      CALL DLIMX(XMIN,XMAX)
      CALL DLIMY(YMIN,YMAX)
      CALL XFRM(4)
      CALL YFRM(4)
      CALL CHECK(A1,A2)
      CALL DSPLAY(A1,A2)
      CALL CHRSIZ(4)
      IF(IFLOW .LT. 0) GO TO 250
      DO 200 J=1,JMAX
      CALL FFORM(Z(J),6,1,IAR,32)
      CALL JUSTER(6,IAR,1,32,LEN,IOFSET)
      CALL MOVEA(X(J),Y(J))
      CALL HLABEL(1,43)
      CALL MOVREL(IOFSET,-5)
      CALL HLABEL(LEN,IAR(6-LEN+1))
  200 CONTINUE
  250 CALL BELL
      CALL TSEND
      CALL TINPUT(ICR)
  300 IF(IHI .NE. 1) RETURN
      DX=(XMAX-XMIN)*0.1
      DY=(YMAX-YMIN)*0.1
      XX=0.0
      YY=0.0
      ANUM=XMIN
      CALL NUMBER(XX,-0.25,0.1 ,ANUM,0.0,1)
      CALL PLOT(XX,YY,3)
```

```
      DO 310 I=1,10
      XX=2.*FLOAT(I)
      ANUM=ANUM+DX
      CALL PLOT(XX,YY,2)
      CALL PLOT(XX,-0.1,2)
      CALL NUMBER(XX,-0.25,0.14,ANUM,0.0,1)
      CALL PLOT(XX,YY,3)
  310 CONTINUE
      XX=0.0
      ANUM=YMIN
      CALL NUMBER(-0.25,YY,0.14,ANUM,90.,1)
      CALL PLOT(XX,YY,3)
      DO 320 I=1,10
      YY=2.*FLOAT(I)
      ANUM=ANUM+DY
      CALL PLOT(XX,YY,2)
      CALL PLOT(-0.1,YY,2)
      CALL NUMBER(-0.25,YY,0.14,ANUM,90.,1)
      CALL PLOT(XX,YY,3)
  320 CONTINUE
      SIZ=20./(YMAX-YMIN)
      IF(IFLOW .LT. 0) RETURN
      DO 400 J=1,JMAX
      XX=X(J)*SIZ
      YY=Y(J)*SIZ
      CALL PLOT(XX,YY,3)
      CALL MARKER(1)
      CALL NUMBER(XX+0.1,YY,0.14,Z(J),0.0,1)
  400 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SPLINE(X,Y,XP,YP,A,B,C,D,T,S,MX,SIZ)
      COMMON/CONTRL/NCONTR,VAL(20),IFLOW,INUM,JMAX,NELM,IPTS
      COMMON/HIPLOT/IHI,ITEK
      COMMON/MXMN/XMAX,XMIN,YMAX,YMIN,XC,YC
      DIMENSION X(1),Y(1),YP(1),XP(1),A(1),B(1),C(1),D(1),T(1),S(1)
      DIMENSION IAR(6)
   50 MORE=0
      IPRNT=0
      IPRNTD=0
      VAK=0.0
      DO 150 I=1,MX
      READ(7) V,X1,Y1
      IF(EOF(7)) 200,100
  100 IF(I .EQ. 1) VAK=V
  110 IF(VAK .NE. V) GO TO 190
      X(I)=X1
      Y(I)=Y1
  150 CONTINUE
      MORE=1
  190 BACKSPACE 7
  200 I=I-1
      IF(I .LE. 0) GO TO 400
      IF(ITEK .NE. 1) GO TO 210
      CALL FFORM(ABS(VAK),6,1,IAR,32)
      CALL CHRSIZ(4)
      CALL JUSTER(6,IAR,0,32,LEN,IOFSET)
  210 CONTINUE
      NOUT=IPTS*I
      J=1
      CALL CURVE(I,X,Y,NOUT,XP,YP,A,B,C,D,T,S)
      IF(ITEK .EQ. 1) CALL MOVEA(XP(1),YP(1))
      IF(IHI .GT. 0) CALL PLOT(XP(1)*SIZ,YP(1)*SIZ,3)
  215 J=J+1
      XX=XP(J)*SIZ
      YY=YP(J)*SIZ
      IPRNT=IPRNT+1
      IF(MOD(IPRNT,INUM)) 290,220,290
  220 IF(ITEK .EQ. 1) CALL MOVREL(IOFSET,-5)
      IPRNTD=1
      IF(IHI .GT. 0)
     1 CALL NUMBER(XX,YY,0.21,ABS(VAK),0.0,1)
      XX1=XP(J-1)*SIZ
      YY1=YP(J-1)*SIZ
      IF(IHI .GT. 0) CALL PLOT(XX1,YY1,3)
      IF(ITEK .EQ. 1) CALL HLABEL(LEN,IAR(6-LEN+1))
      IF(ITEK .EQ. 1) CALL MOVEA(XP(J-1),YP(J-1))
      IF(IPRNTD .EQ. 2) GO TO 50
  290 IF(ITEK .EQ. 1) CALL DRAWA(XP(J),YP(J))
      IF(IHI .GT. 0) CALL PLOT(XX,YY,2)
      IF(J .LT. NOUT) GO TO 215
      IF(MORE .GT. 0) GO TO 50
      IF(IPRNTD .GT. 0) GO TO 50
      IPRNTD=2
      K=1
      IF(ITEK .EQ. 1) CALL MOVEA(XP(K),YP(K))
      IF(IHI .GT. 0) CALL PLOT(XP(K)*SIZ,YP(K)*SIZ,3)
      GO TO 220
  400 CONTINUE
      IF(ITEK .NE. 1) RETURN
      CALL BELL
      CALL TSEND
      CALL TINPUT(ICR)
      RETURN
      END
```

```
      SUBROUTINE CURVE(NUMIN,XIN,YIN,NUMOUT,XOUT,YOUT,A,B,C,D,T,S)
      DIMENSION XIN(1),YIN(1),XOUT(1),YOUT(1)
      DIMENSION A(1),B(1),C(1),D(1),T(1),S(1)
      S(1) = 0.0
      DO 100 I = 2, NUMIN
      D1 = XIN(I)-XIN(I-1)
      D2 = YIN(I)-YIN(I-1)
  100 S(I) = S(I-1)+SQRT(D1*D1+D2*D2)
  400 CALL SPLCOF(S,XIN,NUMIN,A,B,C,D,T,2.,0.,2,0.)
      DS=S(NUMIN)/(NUMOUT-1)
      DO 500 I = 1, NUMOUT
      TT = DS*(I-1)
  500 CALL SPLTRP(S,XIN,NUMIN,T,0,TT,XOUT(I))
      CALL SPLCOF(S,YIN,NUMIN,A,B,C,D,T,2,0.,2,0.)
      DO 600 I = 1,NUMOUT
      TT = DS*(I-1)
  600 CALL SPLTRP(S,YIN,NUMIN,T,0,TT,YOUT(I))
      RETURN
      END
```

```
      SUBROUTINE SPLCOF(X,Y,N,A,B,C,D,T,I1,V1,I2,V2)
C     THIS ROUTINE COMPUTES THE VECTOR OF SECOND DERIVATIVES
C     IN ARRAY T WHICH ARE NEEDED TO SPLINE INTERPOLATE
C     TABULAR DATA STORED IN X AND Y. ALLOWED END CONDITIONS
C     INCLUDE SPECIFICATION OF Y" OR Y"" AT EACH END.
C     WHEN I1 IS 1 OR 2 THEN V1 IS CHOSEN VALUE OF
C     Y" OR Y"", RESPECTIVELY, AT X=X(1). I2 AND V2 HAVE A
C     SIMILAR MEANING FOR THE RIGHT END AT X(N).
      DIMENSION X(1),Y(1),A(1),B(1),C(1),D(1),T(1)
C     FORM THE TRIDIAGONAL SYSTEM DEFINING THE SPLINE
C     COEFFICIENTS.
      N1 = N-1
      DO 10 J = 2, N1
      HJ = X(J)-X(J-1)
      HJ1=X(J+1)-X(J)
      HJP = HJ+HJ1
      A(J) = HJ/HJP
      B(J) = 2.
      C(J) = 1.-A(J)
   10 D(J)=6.*((Y(J+1)-Y(J))/HJ1-(Y(J)-Y(J-1))/HJ)/HJP
C     FORM THE EQUATIONS FOR THE END CONDITIONS.
      IF(I1 .EQ. 2) GO TO 20
      H2 = X(2)-X(1)
      B(1) = 2.
      C(1) = 1.
      D(1) = 6.*((Y(2)-Y(1))/H2-V1)/H2
      GO TO 30
   20 B(1)=1.
      C(1) = 0.
      D(1) = V1
   30 IF(I2 .EQ. 2) GO TO 40
      HN = X(N)-X(N-1)
      A(N) = 1.
      B(N) = 2.
      D(N) = 6.*(V2-(Y(N)-Y(N-1))/HN)/HN
      GO TO 50
   40 A(N) = 0.
      B(N) = 1.
      D(N) = V2
C     SOLVE FOR T(1), ... , T(N) USING GAUSS REDUCTION
   50 DO 60 K = 1, N1
      R = A(K+1)/B(K)
      B(K+1) = B(K+1)-R*C(K)
   60 D(K+1)=D(K+1)-R*D(K)
      T(N) = D(N)/B(N)
      DO 70 J = 1, N1
      K = N-J
   70 T(K)=(D(K)-C(K)*T(K+1))/B(K)
      RETURN
      END
```

```
      SUBROUTINE SPLTRP(X,Y,N,T,ID,XT,FT)
C     THIS ROUTINE PRODUCES A SPLINE INTERPOLATION VALUE FT
C     CORRESPONDING TO AN X-POSITION XT. WHEN ID EQUALS
C     0,1,2 OR 3, THEN FT TAKES THE VALUE OF Y, Y", Y"", OR
C     THE INTEGRAL OF Y*DX BETWEEN LIMITS X(1) AND X. THE
C     ORIGINAL DATA POINTS ARE STORED IN X(I), Y(I), I=1,
C     ... ,N.  THE VECTOR T CONTAINS THE Y"" VALUES RETURNED
C     FROM SUBROUTINE SPLCOF.
      DIMENSION X(1), Y(1), T(1)
      ID1 = ID+1
C     CHECK WHETHER XT IS OUTSIDE THE ORIGINAL DATA RANGE
      IF(XT .LT. X(1)) GO TO 80
      IF(XT .GT. X(N)) GO TO 120
C     DETERMINE THE FIRST DATA POINT TO THE RIGHT OF XT
      DO 30 J = 2, N
      IF(X(J) .GE. XT) GO TO 40
   30 CONTINUE
   40 J1 = J-1
      HJ = X(J)-X(J1)
      HJ6 = 6.*HJ
      GO TO (50,60,70,72), ID1
   50 FT=(T(J1)*(X(J)-XT)**3 + T(J)*(XT-X(J1))**3
     $   +(6.*(Y(J)-Y(J1))-(T(J)-T(J1))*HJ**2)*(XT-X(J1))
     $   +6.*HJ*Y(J1)-T(J1)*HJ**3)/HJ6
      RETURN
   60 FT=(-3.*T(J1)*(X(J) -XT)**2+3.*T(J)*(XT-X(J1))**2
     $   +6.*(Y(J) - Y(J1)) - (T(J) - T(J1))*HJ**2)/HJ6
      RETURN
   70 FT=(T(J1)*(X(J)-XT) + T(J)*(XT-X(J1)))/HJ
      RETURN
   72 HX =XT-X(J1)
      FT=.25*T(J1)*(HJ**4-(HJ-HX)**4)+.25*T(J)*HX**4
     $   +(3.*(Y(J)-Y(J1))+.5*(T(J1)-T(J))*HJ**2)*HX**2
     $   +(6.*Y(J1)*HJ-T(J1)*HJ**3)*HX
      FT=FT/HJ6
      IF(J .EQ. 2) RETURN
      DO 74 K = 2, J1
      HK = X(K)-X(K-1)
   74 FT=FT+0.5*(Y(K-1)+Y(K))*HK-(T(K-1)+T(K))*HK**3/24.
      RETURN
   80 H2 = X(2)- X(1)
```

```
C     DETERMINE THE SLOPE AT THE LEFT END AND INTERPOLATE
C     LINEARLY.
      SLOPE=(Y(2)-Y(1))/H2 - (2.*T(1)+T(2))*H2/6.
      GO TO (90,100,110,115), ID1
   90 FT=Y(1) + SLOPE*(XT-X(1))
      RETURN
  100 FT=SLOPE
      RETURN
  110 FT=0.
      RETURN
  115 HX=XT-X(1)
      FT=Y(1)*HX+0.5*SLOPE*HX**2
      RETURN
C     DETERMINE THE SLOPE AT THE RIGHT END AND INTERPOLATE
C     LINEARLY.
  120 HN=X(N) - X(N-1)
      SLOPE = (Y(N)-Y(N-1))/HN + (T(N-1)+2.*T(N))*HN/6.
      GO TO (130,100,110,140), ID1
  130 FT=Y(N) + SLOPE*(XT-X(N))
      RETURN
  140 HX=XT-X(N)
      FT=Y(N)*HX + 0.5*SLOPE*HX**2
      DO 150 J = 2, N
      HJ=X(J) - X(J-1)
  150 FT=FT+0.5*(Y(J-1)+Y(J))*HJ-(T(J-1)+T(J))*HJ**3/24.
      RETURN
      END
```

DISTRIBUTION

	No. of Copies
US Army Missile Research and Development Command Basic Distribution List	34
Defencse Documentation Center Cameron Station Alexandria, Virginia 22314	12
Commander US Army Materiel and Readiness Command Attn: DRCRD	1
DRCDL	1
5001 Eisenhower Avenue Alexandria, Virginia 22333	
Superior Technical Services, Inc. 4308 Governors Drive Attn: D. Creel	1
Huntsville, Alabama 35805	
DRSMI-FR, Mr. Strickland	1
-LP, Mr. Voigt	
DRSMI-W	
-WSP, Mrs. Rogerson	1
-WSE, Mr. Gibbs	1
Mr. Sellers	1
DRDMI-X, Dr. McDaniel	1
-T, Dr. Kobler	1
-C	1
-ES	1
-ET	1
-M	1
-N	1
-TBL	5
-TD	1
-TE	1
-TG	1
-TK	1
-TL, Mr. Lewis	1
-TLA, Mr. Pettey	1
Mr. Patrick	10
Dr. Richardson	1
Dr. Smith	1
Mr. Van Bebber	1
Mr. Eppes	1

	No. of Copies
DRDMI-TR	1
-TB	3
-TI (Record Set)	1
(Reference Copy)	1